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ABSTRACT

Presented is a resource book to be used with instructional kits for elementary school science students, grade 2. The individual units at this grade level are based on curriculum which has been developed by the National Science Foundation in the 1960s and revised to meet student and teacher identified needs in Anchorage, Alaska. Four units are included within this guide. Each unit lists kit and non-kit items, supplemental materials, teacher background information, and proposed schedule. Worksheet masters are also included. Unit topics include Atoms and Molecules, Plants and Animals, Sound, and Force and Motion. (CS)

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ELEMENTARY SCIENCE GUIDE

2ND GRADE

1978

SUPERINTENDENT OF SCHOOLS
ANCHORAGE SCHOOL DISTRICT
4600 DEBARR ROAD
ANCHORAGE, ALASKA 99504

SE 031 446

JUL 15 1980

FOREWORD

This Resource Book has been prepared for use with instructional kits distributed through the Anchorage School District Science Center. These kits were developed by the Elementary Science Curriculum Committee under funding by ESEA Title IV B & C in response to student and teacher identified needs.

The individual units at each grade level are based on curriculum which has been developed by the National Science Foundation in the 1960's. The curriculum has been taught by thousands of teachers throughout the United States. The Anchorage School District adopted this curriculum and our Anchorage teachers have adapted it to fit our needs and our scope and sequence. The Anchorage School District is enthusiastic about this effort and believe that this guide and the Science Center will represent more effective and efficient ways of teaching science.

The process of curriculum planning and development requires the help of many teachers, principals and administrators. We appreciate the cooperation and assistance of everyone who has contributed to this project.

E.E. (GENE) DAVIS, ED.D
ASSISTANT DEPUTY SUPERINTENDENT

EED:dc

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The development of this guide represents the contribution of many talented people during the past two to three years. We are very grateful to the following people for the unique contribution each of them made in developing our science program.

The guide material was written by the following people:

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(To be taught in any sequence)

Atoms and Molecules

Plants and Animals

Sound

Force and Motion

OUTCOME STATEMENT

For Students Grades K-6 -- Science

The major outcome of science education in the Anchorage Schools is the development of scientifically literate citizens. A scientifically literate person is generally described as a person who:

- Understands enough of the fundamental concepts of the physical and biological nature of the world so that he/she may act responsibly.
- Possesses science skills and processes that give rise to facts and concepts.
- Possesses attitudes or values generally associated with science such as curiosity and respect for data.
- Uses science concepts, skills and values in making decisions as he/she interacts with other people and with his/her environment.
- Is aware of the interrelationship taht exists between cultural, philosophical, environmental, and social changes and scientific and technological advancements.

The role of the elementary school is to provide concrete, first hand experiences for students so that they may <u>begin</u> the process of becoming scientifically literate citizens. Because a child's mind changes in the manner it operates, and does not simply increase in capacity as it matures, the K-6 outcomes will be concrete and demand direct student observations. Nevertheless, these outcomes are important prerequisites for the later outcomes.

By the end of the sixth grade a student should be able to:

- Observe and describe a simple event using more than one sense.
- Record and share observations with others.
- Classify a set of objects.
- Collect and organize simple data.
- Interpret the meaning of simple data
- Set up a simple experiment to answer a question
- Read scientific materials critically.

OUTCOME STATEMENT (Continued)

- Demonstrate a basic understanding of the function of the ecosystem and his/her relationship to it.
- Demonstrate a basic knowledge of the systems of the human body.
- Demonstrate a basic knowledge of physical science concepts to which he/she has been introduced.

1 Each unit will have:
A. A listing of kit and non-kit items.
B. Supplemental materials list.
C. Teacher background information.
D. A schedule.

2 The units have been developed to be taught anytime throughout the year.

3 The approximate times needed for each unit are included to help you in your long range planning.

4 Worksheet masters are included in your guide for reproducing.

5 Call the Science Center if you have a problem.

PLANTS AND ANIMALS

GRADE 2

PLANTS AND ANIMALS

GRADE 2

KIT

Thumbtacks - 1 box
Pins - 1 box
Corn seeds - 2/student
Grease pencils - 10
Germination boxes - 18
Germination sponges - 18
Potting soil
Mimosa seeds

NON-KIT

Baby food jars - 1/student
Crayon
Potted plant: 1-2 box
Milk cartons

PLANTS AND ANIMALS

Grade 2

INTRODUCTION:

Have you ever been sitting in a library that was very quiet, when suddenly someone dropped a book? Did you notice how everyone's head popped up? Why did all the people react to the noise at the same time?

We explain it by saying that something attracted their attention. The scientist explains it as Response to a Stimulus.

Plants and animals respond in many different ways to the stimuli around them. The responses are called TROPISMS. This unit of work deals with different reactions to stimuli of certain plants and animals. It is one way the children in your classroom can become involved in their world, and learn of the interactions which must exist with all living things. Perhaps you too can find the excitement generated by the activities in the unit.

The unit is composed of three basic parts: plants, tropisms, and animals in Anchorage. There is really no right order for doing the lessons. As you progress with the different lessons you may want to follow the outline. On the other hand, feel free to branch into activities your students show interest in and are suitable in your classroom. REMEMBER, YOU DO NOT HAVE TO BE A SCIENCE EXPERT TO TEACH SCIENCE. EXPLORE WITH YOUR STUDENTS.

SCHEDULE:

The science kit materials are available to you for three weeks. Since several lessons in the unit can continue beyond the request time, it will be necessary that certain activities be done during the three week period. The equipment you return in the kit will not hamper the continuing activities.

The complete unit of work will take about three weeks, with the exception of Lesson #IX. You will need to plant mimosa seeds as soon as possible. A gap of several weeks will be necessary before you can do Lessons III and IV. Go right on through the unit then come back. Discussion and activity periods should last from 1/2 to one hour, three times each week plus a few minutes to tend plants each day. The later activities could be free time activities.

If you read through the guide once or twice you probably can capture the spirit of the activities and you may want to approach the unit in your own way. However, feel free to use the unit as it is written. You will note that the unit sequence begins with setting up an aquarium. This is necessary to keep the fish alive. All of the sections can be woven together using a theme of interaction. The lessons dealing with the aquarium appear to follow each other and indeed they do; however, a few days or even weeks must pass for some of the growth sequence to take place.

Remember you are dealing with living things. Occasionally you can "do everything right" and everything fails. Don't give up - try again.

TEACHER BACKGROUND:

Life is a condition which is found in a complex arrangement of chemical substances occurring in all living things. Living things grow and reproduce. Many living things move about.

Life is a condition of protoplasm. Protoplasm is the living substances found in all living cells. It is a complex group or systems of substances. The activities of protoplasm are what we might call the activities of life.

All living things come from other living things. They inherit size and form from their parents. In other words, like produces like. Living things have a determined life span. No form of life can exist indefinitely. Living things maintain constant activity. Life activity does not refer only to visible signs of life, such as moving around, but to the activity of the protoplasm in the plant or animal. The activities of plants and animals is called their life functions, or life processes. These life processes or functions are as follows: 1) ingestion of food substances, 2) digestion, 3) absorption, 4) respiration, 5) assimilation, 6) excretion, 7) motion, 8) secretion, 9) sensitivity, and 10) reproduction.

Living things have a critical relationship with their environment. Factors such as temperature, rainfall, humidity, or water vapor in the air, winds, and air currents, soil condition, and variations in the surface of the earth have a direct influence on the life of different areas. As these conditions vary, plants and animals in the region vary. Desert animals and plants could not survive in a swampy area.

Livings things respond to the conditions around them. Only living protoplasm has the property of reacting to its environment. Non-living things may be influenced by the environment, as water freezes and become ice, but protoplasm is the only substance which is capable of responding to a stimulus. Living things must reproduce. Reproduction is the ability to produce new living things that are similar to the parents. Living things have a survival problem. Plants and animals face a constant struggle for life. Much of this struggle centers around requirements for life. If the living things cannot adapt to changes in their environment, they must move to a different area that satisfies their needs, or they will die.

NECESSITIES OF LIFE:

All living things must be able to carry on their life processes or they will die. To carry on these processes, they require certain conditions in their environment. These conditions of the environment are called factors of the environment and are divided into two groups: physical factors and biotic factors. Soil conditions, temperature, light, water, atmospheric conditions, and topography of the region are some physical factors. All living things of any area are considered the biotic factors.

Soil is a basic factor of the environment. Soil varies greatly in different regions. The plants and animals that the soil supports vary accordingly.

Temperature is a controlling factor of the environment. All temperature changes affect the plants and animals of a region. Any organism must be able to withstand the slight variations of day and night as well as seasonal changes of that region.

Water is essential for all life. To meet their critical water needs, plants and animals range from organisms living in a complete water environment to those thriving in the sun-parched deserts. Each organism has adapted to the specific area in order to survive there.

Light is a critical factor in the environment. Light is essential to all green plants in food-making. Some plants though, have adapted to living without light and are what we call parasites. Some animals and some microscopic organisms also have adapted to living without light. Careful study of the organisms that live in darkness has revealed that they depend indirectly on light for existence. Light conditions vary from place to place just as temperatures do. Plants and animals have adapted to their environment and thus to the variations of light.

The atmosphere of an area is another factor of that environment. Air and water are both places that must meet the need (oxygen supply) of the plants and animals of that area. Air pressure, winds and currents, humidity, as well as oxygen supply, are things that might vary from region to region.

Topography is the physical features of the earth. These features change very slowly, but have a great effect on the living things of a region. Changes in the area also change the plant and animal communities of that area.

Biotic factors include all plants and animals of a given area. The biotic factors of an area are determined by the physical factors of that area.

ECOLOGY

Ecology is the study of organisms and their relationship to their environment. The environment is all living and non-living things that act upon that organism. Plants and animals live in communities that are more or less separated from one another by natural barriers. The makeup of each community is dependent upon the physical factors of that environment. The plants of the communities are the primary food producers. The plants of the sea are algae. The plants of the land are mostly seed plants.

The available food supplies vary with changes in the seasons. They may also vary from one year to another. In the plants, these foods are produced through the process of photosynthesis. In seed plants, this process is a result of the combined activities of the leaves, stems, and roots. The leaves are usually the main food-making centers, while the roots absorb water and minerals from the soil, and the stems hold the plants up in contact with sunlight as well as serve as pathways for fluids and nutrients.

The process of passing energy or food from one organism to another in a community is called a food chain. You start a chain with the sun and its supply of radiant energy. The plants absorb the energy and lock it into molecules of sugar, which is made from carbon dioxide in the air and from water and some minerals of the ground. Some minerals from the ground supply plants with the elements to make protein. The energy locked in plants is eaten by animals which need the energy for their survival. Some animals will eat other animals for their energy. If a plant or animal dies, organisms live off the remains and decompose it. The dead organism gives energy to parasites as well as minerals back to the soil. Plants again use the minerals and the cycle goes on.

Food groups of any community include the food makers, herbivores, carnivores, omnivores, parasites, and saprophytes. Complex food chains exist, in which the materials produced by the food makers are passed along from one organism to another. When food chains are disrupted, many organisms in the community may be adversely affected.

Successions take place in community life, and a species, which is abundant at one time, may be far less common at another time. Plant succession leads to the development of a large, old population and a balanced community. When there is a balance in nature, no food group is excessively large.

Many cycles or chains are found in nature, and it is very important for an ecologist to be familar with these. Food is produced by living things and food is needed by living things. Living things store energy and use energy. Oxygen is given off and oxygen is used. Throughout life, plants and animals grow through constructive processes, only to be destroyed after death by other living things. Cycles that become apparent upon close observation are the oxygen cycle, carbon dioxide cycle, nitrogen cycle, and energy cycle.

The relationship organisms have is determined by the step they hold on a food chain or food web. They are either producers (all plants), consumers, or decomposers. Animals form a prey/predator relationship on a chain such as this. There may be many food chains in a community and a few food webs. It takes many food chains to make up a web.

The type of community life is determined by the physical environment of the area. Different communities include ponds, marshes, sea shore, forest, grassland, tundra, and so on. There may be a variety of communities in a large area called a Biome. The biomes include arctic, desert, temperate hardwood forest, tropical, rain forest and marine. Animals and plants have adapted to their specific biome, but may fluctuate at times between some communities.

CLASSIFICATION:

Since ancient time various scientists have attempted to devise a system for grouping and naming living and non-living things. The classification of these things helps in their study and use by scientists. Scientific classification is one of the best examples of the close cooperation of the biologists of the world. Their nationalities, customs, and native tongues may be different, but in the realm of science, they speak the same language because all classification is either in Latin or Greek. Through international cooperation, most organisms of the earth have been placed in orderly groups which are based on structural characteristics.

Common names can be very confusing when studying many kinds of animals. One person might be talking about a type of bear. There are many types of bears in many areas of the world. If the person names the scientific name of the bear, other people will know exactly what it looks like and where it is found. This can be similar to a persons name (see chart below).

Classification of a letter:	Country:	United States
	State:	Washington
	City:	Seattle
	Street:	Madison
	Number:	2435
	Surname:	Smith
	First Name:	John
Classification of Grasshopper:	Kingdom:	Animalia
	Phylum:	Arthropoda (jointed-foot animals)
	Class:	Insecta (all insects)
	Order:	Orthoptera (straight-winged)
	Family:	A cridiidae (locusts)
	Genus:	Schistocerca (cleft-tail)
	Species:	Americana (American)

Plants and animals vary greatly around the world. Through an orderly classification, they can be studied more easily and used more readily.

SCIENTIFIC METHOD

The attitude with which you approach a problem is very important to the way the problem or experiment will turn out. The scientific attitude is one which is characterized by: 1) open-mindedness - a scientist must free his mind from prejudice and never reject knowledge because it happens not to agree with an idea of his own, 2) careful judgment - never jump to conclusions, 3) desire to learn - healthy curiosity, wanting to know the "why" of things, 4) belief in cause and effect - things happen for a reason, and 5) active concern for human welfare - produce better things for better living.

The way most people go about solving a problem can be outlined and follows steps we call the scientific method. This outline or method of solving problems is as follows:

1. Recognize a problem and define the problem.
2. Collect information related to the problem.
3. Form an idea or hypothesis as to how the problem may be solved.
4. Experiment to prove or disprove the hypothesis.
5. Observe the experiment.
6. Organize and record data from the experiment.
7. Draw conclusions from data.

The solving of problems may contain all or a few of these steps. The main idea is to define a problem, study the problem, and solve the problem from information gained by observing and studying.

EVALUATION:

Did my children learn anything from this unit of work? If so, what?

Did my children:

1. Learn something of an organism - environment relationship?
2. Learn how to explore on their own?
3. Ask more questions after the lesson than before?
4. Observe natural events in an ecosystem?
5. Experiment to answer questions stimulated by their observations?
6. Apply what they have learned to new situations?
7. Report their findings of the results of an experiment?
8. Find books to support their ideas?

These are just a few of the points your children will gain in the activities outlined in the unit of work!

LESSON I: ROOTS AND ROOT HAIRS GROW DOWN (Geotropism)

Concepts: To observe and describe roots and root hairs.

To describe how gravity influences the direction in which roots of a plant grow.

Materials:

KIT

Thumbtacks - 1 box
Pins - 1 box
Corn seeds - 2/student
Grease pencils - 10
Germination boxes - 18
Germination sponges - 18

NON-KIT

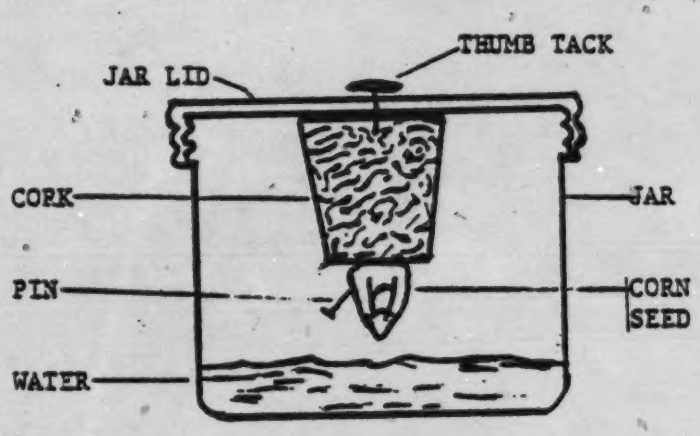
Baby food jars - 1/student
Crayon

* The aquarium activities and tropism activities are independent of each other and can be introduced at anytime. If you need to grow Mimosa pudica, plant them as soon as the unit arrives!

* You will need to soak corn seeds for a day or two before this activity. Soaking the seeds over a weekend would allow you to begin this activity on Monday (one corn seed per child).

Procedure:

1. Draw the following picture on the board. Ask your students to set up their baby food jars as shown. Once they have accomplished the job, have them place a small amount of water in the jar and screw the lid on tight. They should then set the apparatus aside for a day or two.



(Lead-off Question)

2. After several days the lid can be carefully removed and the seed's root hairs can be examined. Ask, "What has happened to the corn seed?" "What are small hair like things?"

3. The students can place the jar lid, with the seed pointing up, on the stage of the stereo-microscope included in the kit.

4. The students should record what they see by drawing pictures of the corn seed and root structure.

(Follow-up Question)

5. Ask, "What do you think root hairs do?" "Why was the seed grown inside the bottle and not out in the air?"

6. Suggest that part of the class take the lid off the jar and leave it off for a few hours and then examine the root hairs again.

(Follow-up Question)

7. Ask, "What happened to the root hairs?"

8. Ask, "What would happen if we turned the bottle over onto the lid and left it for a few days?"

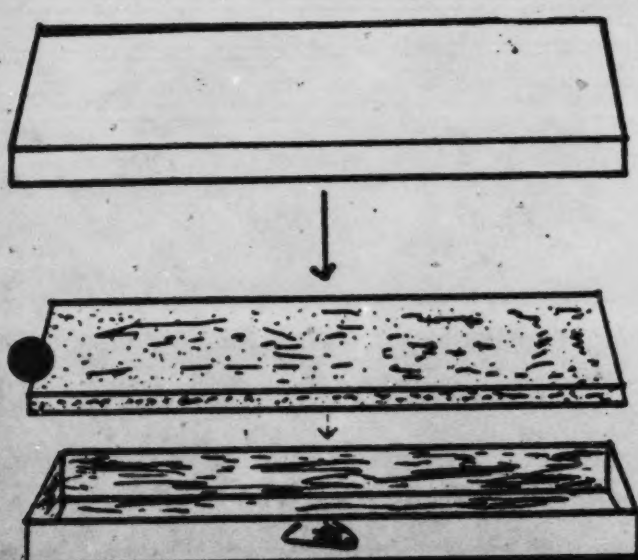
9. Have the children turn the jars over and leave. Make sure the lids are on tight so the water does not run out. There doesn't have to be much water in the jar.

10. After the students have completed step #9 above have them obtain a sponge, germination box and corn seed you have laid out on the front table. <u>Students will work in groups of two</u>. They should then follow these directions:

    a. Place the seed in the bottom of the germination box. Place the wet sponge on the top of the seed.

    b. Put the lid on the germination box and stand the box on its side. Label this side No. 1 with a crayon. Sides No. 2, 3, 4, should also be labeled at this time in a clockwise manner.

    c. Put the box away so side No. 1 is down.



Drawing 1	Drawing 2
Drawing 3	Drawing 4

(Follow-up Question) 11. Ask, "Which way do roots grow?"

12. At this time the students might observe the baby food jars to confirm what has happened in the germination boxes.

(Follow-up Question) 13. Other questions might be helpful at this point. Ask, "If you plant a seed on the side of a hill, which way will the root grow?" "How would you stand on the side of a hill?" "Is there any relationship between the way you stand on a hill and the way the trees stand?" "What force determines the position of a tree?"

LESSON II: PLANTS RESPOND TO WATER (Hydrotropism)

Concept: To identify and state the observed changes in a plant.

Materials:

KIT	NON-KIT
Potting Soil	Potted Plant: 1-2 Box

* You will need a potted plant for this lesson and lesson eight. These are not provided in the kit. Perhaps one of your children can bring a plant from home. A geranium plant, tomato plant, or coleus plant will work well.

Procedure:

1. Do not water the potted plant for a few days prior to doing this experiment.

2. Begin the activity early in the school day!

3. Put a wilted potted plant where the class may observe it.

(Lead-off Question)

4. Ask, "Can you describe this plant to me?" The children will probably describe color, curled and wrinkled leaves, leaves bent downward, stem bent over. You might want the children to feel the limpness of the leaves and stem.

5. Put the potted plant in a container so that excess water which flows out from the bottom of the pot will not spill over. An aluminum foil dish will work. Have a child add water to the soil in the pot until the soil is flooded. Note the time when the water is added.

6. Two or three times during the day have the children observe any changes. You might want to record these changes on the board.

(Follow-up Question)

7. Ask, "Which changes occurred first? Second? Third?
"Did the leaves respond before the stem?"
"Did each leaf change at the same time?"
"How long after the water was added did the plant begin to respond?"
"Will the plant wilt as fast as it reacts when it gets water?"

LESSON III: PLANTS RESPOND TO LIGHT (Phototropism)

Concept: To describe the motion of stems and leaves responding to a stimuli.

Materials:

KIT	NON-KIT
Potting Soil	Potted Plant: 1-2 Box

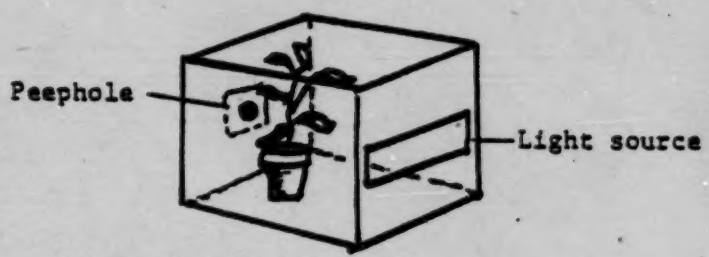
* You will need a potted plant for this activity. A pot of seedlings will also work. If one of your children has grass seed at home, that he can bring, plant it in a milk carton. The carton of planted grass can then be used in the activity.

Procedure:

1. Put a healthy, rapidly growing potted plant or potted milk carton containing grass seed on a shelf as far from the windows as possible.

2. Put a cardboard box over the plant. The box should have a peep hole on one side. On the end opposite the potted plant cut an opening about one third the size of the end.

3. Face the box so that the large opening is toward the lighted window. With a paper fastener, attach a card over the peephole.



4. In a day or so the leaves will begin to turn toward the light.

5. Ask the children to look at the potted plant through the peephole.

(Lead-off Question)

6. Ask, "Do you observe any changes?"
"What caused the plant to change?"
"Has anyone touched the plant?"
"What would happen to the plant if we turned it around?"
"Would the plant become straight if we kept turning it?"

7. Be sure and water the plant regularly.

8. If a student has brought grass seed you might want to show what total darkness can do to the growing plant.

9. Plant two containers (milk cartons) with grass seeds. Use plenty of seeds. Water and set aside for three or four days.

10. When the roots and stems have just emerged, place one container in a box that is dark - the other in the sunny part of the classroom.

11. After a few days the children will begin to see the light-exposed seedlings are green and have long roots, the seedlings kept in the dark are yellow, are taller and have very small roots.

12. You might want to reverse the container after a week or two.

LESSON IV: PLANTS RESPOND TO TOUCH (Thigmotropism)

Concept: To describe the motion of stems and leaves responding to a stimuli.

To observe that "all" living things move.

Materials:

KIT	NON-KIT
Potting Soil	Milk Cartons
Mimosa Seeds	

* It will be necessary for you to plant 10-12 cartons of two or three seeds each. It will take about four weeks for the first leaves to appear.

Procedure:

1. This exercise is designed to overcome the common view that plants are inactive, immobile, and unresponsive. All plants move.

(Lead-off Question)

2. Ask, "What can you tell me about the movement of plants?

   Your children will probably talk of leaves and limbs moving in the wind and about a flower and how it grows.

3. Show the students the Mimosa pudica plants.

(Follow-up Question)

4. Ask, "Can you find out how this plant might move?"

5. If the children have talked about plants moving in the wind, suggest that one of them blow on the plant while the others watch.

(Follow-up Questions)

6. Have a child touch a leaf - Ask, "How hard do you have to touch a leaf to get a reaction?"
   "Does it matter where you touch the leaf?"
   "Is the reaction always the same?"
   "Is the response very fast?" "How fast?"
   "Does the plant respond far from the place where it was touched?"
   "Does the leaf die?"
   "Do the leaves return to their open position?"
   "How long does it take?"
   "What if we all blew on the plant?"
   "Does the plant protect itself this way?"

7. You might want to return to the original discussion of "all" living things having movement.

THE MOST COMMON WINTER BIRDS OF THE ANCHORAGE AREA

Shortened Version

Grade 2

Compiled from:

"Birds of North America" by
Robbins, Bruun and Zim

"A Field Guide to Western Birds" by
R. T. Peterson

Material from Anchorage Audubon Society

THE MOST COMMON WINTER BIRDS OF THE ANCHORAGE AREA

This portion of the plants and animal unit has several portions which could be done simultaneously, or in order. The seven bird species could be introduced over four different sessions. The activities mentioned do not require the use of the kit, so they can continue after the three weeks sign out time.

The activities are as follows:

I. The seven most common species of winter birds. (Not drawn to the same scale.)

   In the past, children have crayoned dittoed bird pictures and made them into booklets. Real specimens (frozen) may be obtained from Anne Wieland or Milt Madson on a one-day basis! Specimens must be kept frozen except when in the classroom. Please return the hand crayoned laminated pictures with the kit.

II. Parts of birds, ditto off and label.

III. Feeders - Can be used as art proje[illegible]. Become familiar with bird menu.

IV. Chart of sightings.

V. Bird walk (if possible a resource teacher could go with you). Give a talley sheet to each child.

VI. Vocabulary - drawn from the unit according to your children's ability.

SOME WINTER BIRDS OF THE ANCHORAGE AREA

GRADE 2

A. WIELAND

1. Common Redpoll (1903)

Flies in flocks usually. Sometimes more than 100. Prefers birch, alder, weed, and spruce seed. Eats millet from wild bird seed. Easily attracted to feeding stations. Flight irregular, wavy. Sex difference in plumage. Looks like a sparrow but it has a black chin and a red cap. In addition, males have some red under chin and breast, also on the rump.

2. Common Raven (1048)

Large (21") all black scavenger. Commutes daily from woods and hills to garbage dumps, parking lots. Acrobatic flier, see at power plant near Muldoon and Glenn Highway. Walks rather than hops. Early nesting season. Downtown in winter, stays in mountains in summer.

3. Black-capped Chickadee (408)

Says his name, friendly, tame, Redpoll sized. Has a black cap, flits from tree to tree. Easily attracted to feeding stations. Eats sunflower seeds, suet and peanuts. Eats birch seeds in the wild.

4. Pine Grosbeak (406)

Large beak can easily break open seeds. Stays in small flocks. Seed eater, also fruit. Quite tame, easily attracted to feeding stations. Prefers sunflower seeds. Bullies smaller birds especially redpolls at feeding stations. Sex difference in plumage, males have brick red on head and body, females look gray except for wingbars. Females also have olive colored heads and rump. Both sexes have white wingbars. Almost Robin sized bird. Call; 2 or 3 whistles, the second is one note higher than the first. Third, when given, is same not as first.

5. White-winged Crossbill (98)

Population on increase this year. Quite tame. Bill is shaped. Helps in picking seeds out of spruce cones. Fond of salt water environment. Sex difference in plumage. Males have pinkish color and broad white wingbars. Females are more orange-brown. When flying, it has a 3 or 4 note call like a redpoll's only slower. They are slightly larger than a redpoll.

6. Bohemian Waxwing (1)

Much more common in previous years. Eats berries in fall and winter, insects in summer. Red, waxlike spot on wing. Crest. Also frequently eats mountain ash, chokecherry, honeysuckle berries and lilac seeds. Flies in large flocks, visiting one yard after another until all the berries are gone. Hovers a little when coming in for a landing. Call; a soft whistled trill.

7. Black-billed Magpie

Appears mostly black and white. Large bird. Has a tail longer than its body, glides skillfully between branches as it comes in for a landing. Is omniverous, but seems to like roadkills and left over moose carcasses. It also likes to eat dog food especially bones and meat scraps and will tease dogs to get their food. Often travels alone but sometimes in flocks of 10 or 20. Has a hoarse, raucous call of repeated loud notes. Scares away more easily than some of the other birds mentioned here.

THE BIRD FEEDER CHALLENGE

Concept: To construct various feeders.
To observe the feeding characteristics of birds.

Background: Now that you have used the Plants and Animals unit, perhaps you would like to extend the activities to some "real life" situations. One such problem, you might consider, is the "Bird Feeder Problem", described below.

To be successful your students will need to:

1. See the variety of bird feeders shown.
2. Gather bird feeder material from home.
3. Bring various food items birds eat.

The degree to which your children get involved will depend on your ability to excite them with the problem and the, "get out of the way".

The unit of work deals with the technology of constructing an object, then using that object (bird feeder) to study a scientific phenomena. The unit approaches the topic through a group approach. The term "group" can mean different things to different people. To one teacher it means everyone doing the same experiment, working in groups. To another teacher it means groups of students doing different and often unrelated experiments. A schematic of how the various parts of this challenge might fit together is shown on the next page.

The Unit: We have been observing birds in our classroom.

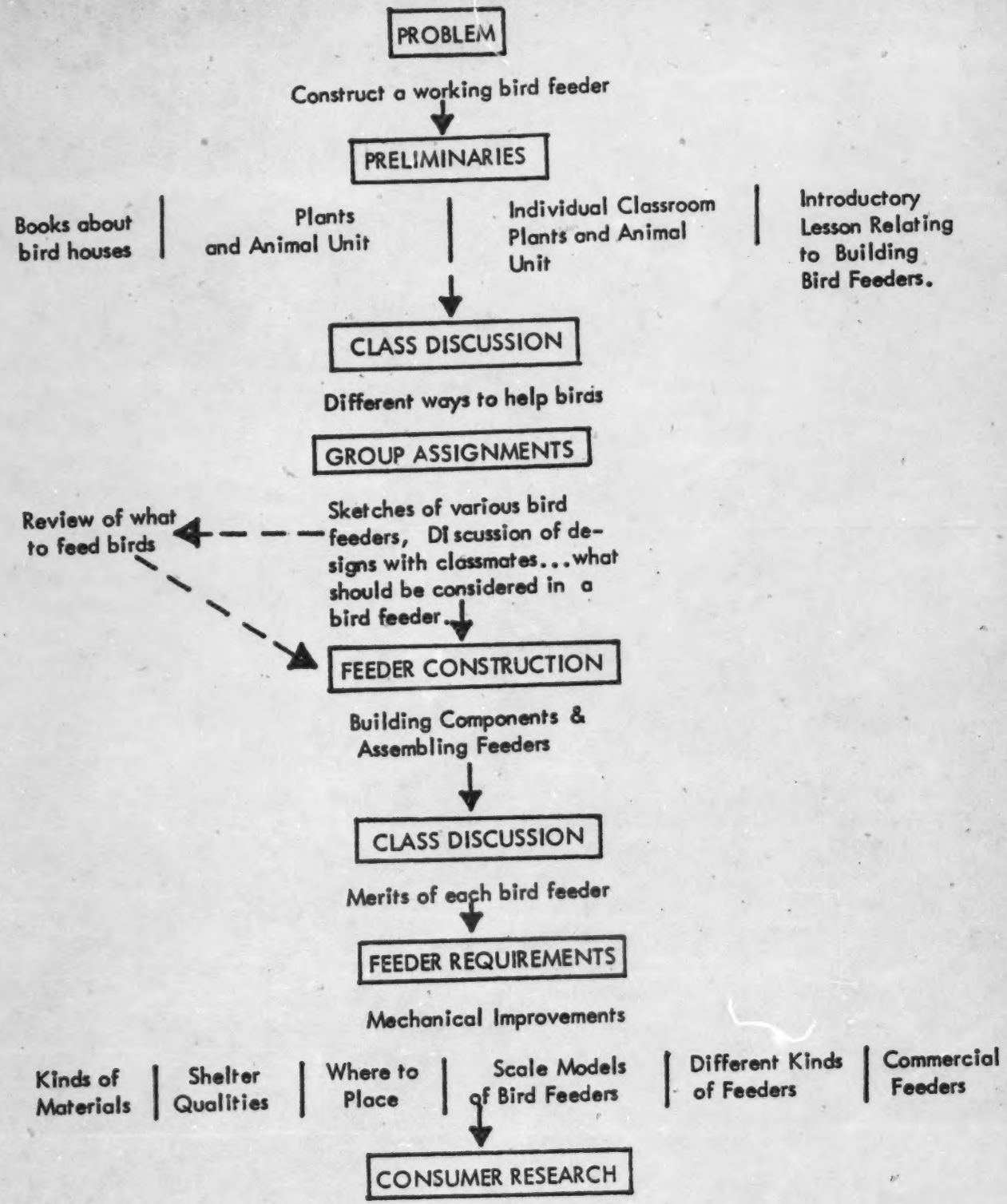
(Transitional Question) How can we find out more about the animals in the areas around school and home?

Possible answers: Going out to their habitat.
Attracting them to us to observe.

What can we <u>attract</u> to our windows to watch at school or at home? Someone will probably suggest birds.

(Lead-off Question) How can we attract birds?

Possible answers: Put out food.
Make bird feeders


PROBLEM
Construct a working bird feeder
PRELIMINARIES
Books about bird houses
Plants and Animal Unit
Individual Classroom Plants and Animal Unit
Introductory Lesson Relating to Building Bird Feeders.
CLASS DISCUSSION
Different ways to help birds
GROUP ASSIGNMENTS
Review of what to feed birds
Sketches of various bird feeders, Discussion of designs with classmates...what should be considered in a bird feeder.
FEEDER CONSTRUCTION
Building Components & Assembling Feeders
CLASS DISCUSSION
Merits of each bird feeder
FEEDER REQUIREMENTS
Mechanical Improvements
Kinds of Materials
Shelter Qualities
Where to Place
Scale Models of Bird Feeders
Different Kinds of Feeders
Commercial Feeders
CONSUMER RESEARCH
Cost of Materials
Why People Help Birds
Design Problems

Using your own ideas or those from the attached pages, build a bird feeder. Ask the children what they think birds eat. Make a list. Have children try putting out the foods one at a time. Do birds come? If so, what kind of birds eat this particular food. Keep track of which birds eat which foods for future reference in making up bird food recipes. Cross food off the list that do not attract birds.

Someone is sure to mention bird seed. Is it really seed? How can we tell? Plant some to see.

Look at beaks of birds when they come to the feeder. Do they have teeth? Compare and discuss different types of beaks with which children are familiar:

Duck:	flat bill for scooping
Eagle:	short and curved for tearing meat
Finch:	short and thick for crushing seeds
Hummingbird:	needlelike bills for sipping nectar

Beaks are shaped so as to help the bird get food, defend themselves, feed their young and build nests.

What else can we observe and learn? Look for differences and similarities in color, shape, size, feet, tails, etc. Do the same birds eat from the ground feeder and the hanging ones? Are some more aggressive? Which ones drive others away? How? By sounds, pecking, aggressive movements? Do those driven off return? How are birds the same or different from other animals?

Some characteristics of birds that may come up in discussions.

1. Birds lay eggs.
2. They usually build some kind of nest as a home for baby birds.
3. Eyes are located on both sides of head.
4. Ears are holes in both sides of head.
5. Birds' bones are hollow
6. The feet of birds are shaped to help them move about and get food.
7. Feathers keep birds warm, dry and help most birds fly.
8. Breast, down and flight feathers have different purposes. Barbs have hooks to hold them together so the air can't get through. The color of the feathers camouflage the birds in its surroundings.

Bird Feeders: There are many ways to build a birdfeeder from miscellaneous free or inexpensive materials. They can be made at home or in school. They may be hung in backyards, placed on the ground, put outside apartment windows or nailed outside a classroom window. In fact, they can be placed almost anywhere. Birdfeeders can be simple or elaborate. They are useful during any season, but you should emphasize that anyone who starts to feed birds at the beginning of winter must keep it up. Birds become dependent on the feeders and remain near them when their other natural food is gone. They may die without the food you provide.

Suggestion: If you make a birdfeeder for outside your classroom window, try to get a piece of mylar to cover that window. You can see the birds outside, but they cannot see in. They are not so easily frightened away by movement in the classroom. Children can get quite close to the window to observe the birds.

Recipes for Bird Food:

Suet: In the winter, many birds need suet for warmth and energy. First, put the suet through a meat grinder. You may be able to get your butcher to do this for you. Some can be used in ground form by pressing into holes in blocks of wood or by packing into a mesh bag. Some should be melted down then allowed to cool and harden. This will be used in mixtures with seeds, cereal, crumbs, and other ingredients. Or, it can be poured into a container and used as a solid suet cake.

Seeds: You will want to supply sunflower seeds as well as wild bird seed mix. Hanging feeders will need a place for birds to perch while eating. Ground feeders are useful too. Ground feeding trays will need holes for drainage.

RECIPES FOR BIRD FOOD

Recipes: Different combinations of food may be mixed with suet to suit the tastes of different birds. Also mix in sand or grit - about one teaspoonful to three cups of food. Following are some ideas.

Suet - Liked by chickadees, woodpeckers, magpies, gray jays, nuthatches. Usually served in a mesh suet bag. It is not necessary to melt the suet and mix seed in it, as is often recommended, as most of our suet-eating birds are not seed eaters.

Millet - Eaten by redpolls and juncos. White millet is the seed that our birds select for eating from the usual wild-bird-mix, other seed in the mix often being refused.

Peanuts (unsalted) - Chopped peanuts are relished by chickadees, redpolls, nuthatches and jays. (The birds' version of caviar!)

Sunflower Seeds - For chickadees, pine grosbeaks, jays. Served in the shell.

Peanut Butter Mixture - for chickadees, jays, nuthatches, woodpeckers, juncos, redpolls, magpies and red squirrels (unscrupulous feeder bandits!) This mixture is one part cornmeal to one part peanut butter. The meal makes an inexpensive extender for the peanut butter, and also provides a grittier mixture less apt to adhere to the inside of the bird's bill. It is believed a steady diet of straight peanut butter can create serious problems for birds whose bills wind up with wall-to-wall peanut butter.

Crumbs - Chickadees will also eat breadcrumbs, but these have to be unsophisticated chickadees who have not become accustomed to peanuts.

SOURCES

Suet - Available at the butcher shop (usually free).

Millet - Watch for good buys at local supermarkets and drugstores on wild bird seed mixtures. White millet (the birds' favorite) may be order from the Mangelsdorf Seed Company, P.O. Box 327, St. Louis, Montana 63166. They charge $2.40/25 lbs. and $4.30/50 lbs. (1978 price list) plus postage. Price list mailed on request.

Peanuts - Expensive to buy locally, but available from the above company at $16.50/25 lbs. for raw, shelled Spanish peanuts. (Roast these thirty minutes in 325° oven.)

Sunflower Seed - Sold locally at Alaska Mill and Seed, 1501 E. 1st, phone: 279-4519. $5 for 5 lbs. $30.25 for 50 lbs.

Also available from Mangelsdorf Company at $5.50/25 lbs. small seed, $6.90/25 lbs. large seed, $10.50/50 lbs. small seed, $13.25/50 lbs. large seed. (Postage for 25 lbs. would be around $8.)

FEEDERS

Feeders can be fancy or home-made. Birds like them all. Avoid ones with metal parts. In sub-zero weather birds have lost eyes when brushing against metal feeders.

The mesh bag from your Thanksgiving turkey will make an excellent suet bag. Sturdy twine bags as well as a squirrel-proof bag constructed of plastic-coated wire can be ordered from the Audubon Workshop, 1501 Paddock Drive, Northbrook, Illinois 60062.

Locate your feeder in a place that will be easy to service when snow lies deep on the ground. Birds are bold and will accept feeders hung right under the eaves or on a porch or deck.

If you are fortunate enough to live in a woodsy area, keep an eye on your feeder after dark — not for owls, but for the Northern Flying Squirrel (a nocturnal feeder raider).

Chart of Sightings - to be made on butcher paper. Tack laminated colored bird pictures above. Use yarn to make a line from picture to birds' name.

Idea by Barb Sell

REDPOLL	RAVEN	MAGBIE	CHICKADEE	BOHEMIAN WAXWING	PINE GROSBEAK	WHITE-WINGED CROSSBILL

BIRD WALK

TOTAL

COMMON REDPOLL

COMMON RAVEN

BLACK-CAPPED CHICKADEE

PINE GROSBEAK

WHITE-WINGED CROSSBILL

BOHEMIAN WAXWING

BLACK-BILLED MAGPIE

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WINTER BIRDS

Optional Activities

1. Bird Mural

   Provide a large area for panoramic mural, organize small groups of children to work on mural at intervals during the day. Each group is responsible for a species of bird and the background for it.

2. Nest Center

   Bring in a nest.

   a. List what nest is made of.
   b. Where did the bird find these materials?
   c. What happens to the nest after bird leaves?
   d. What kinds of birds return to the same nest year after year?

3. Bird Life Cycle

   Have the children draw and color a birds' life cycle.

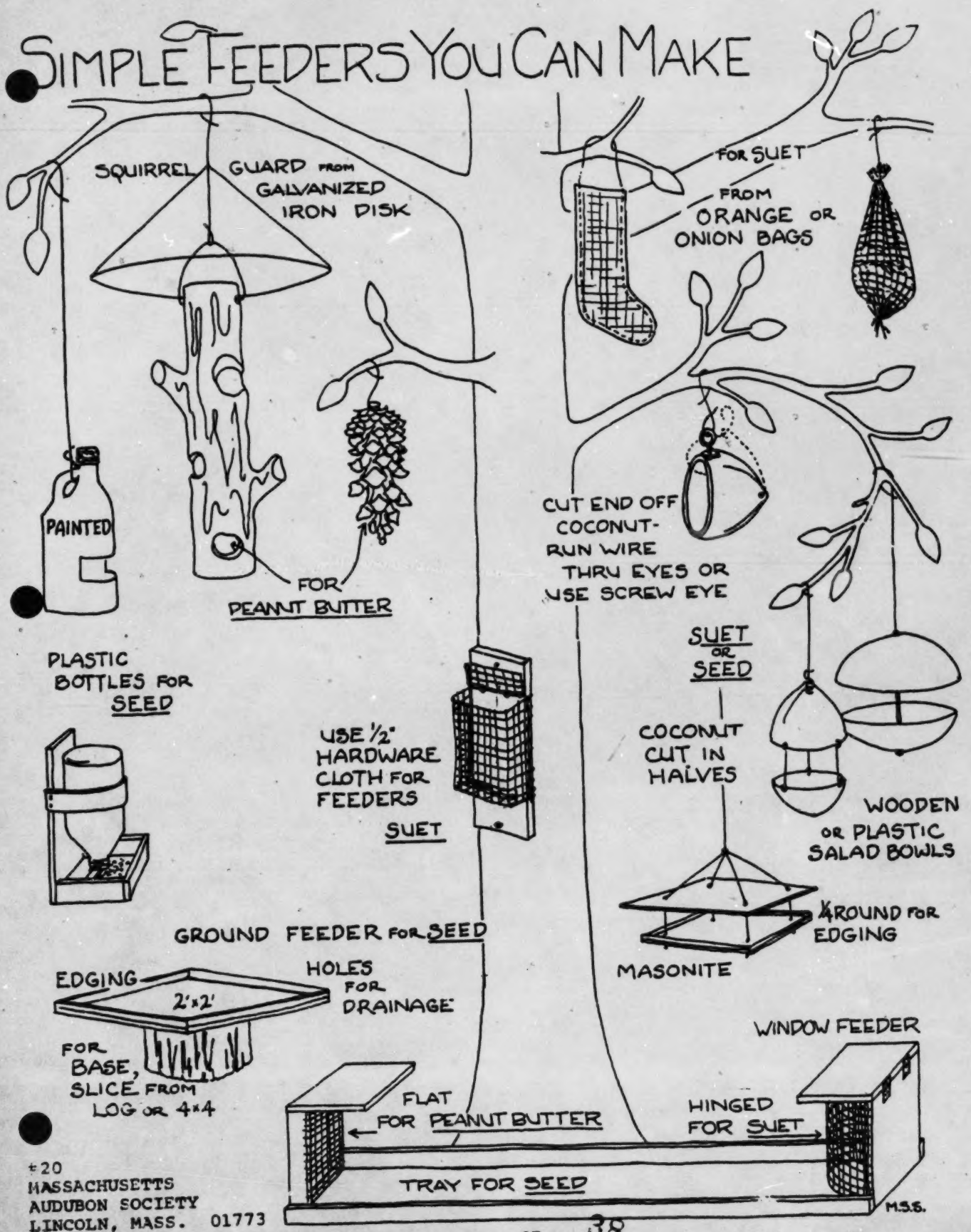
4. Language Arts

   Write stories or poems about life as a bird.

5. Potter Marsh Slide Show

   Can be used any time but best scheduled before return of waterfowl in April. Order through regular film scheduling.

SIMPLE FEEDERS YOU CAN MAKE



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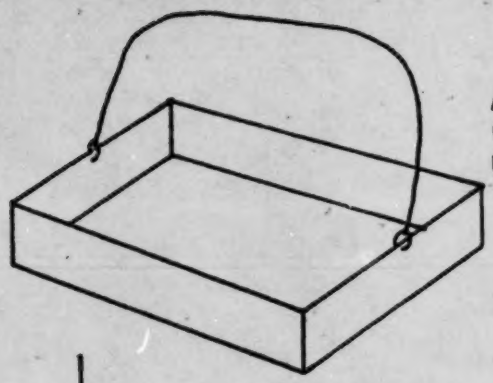
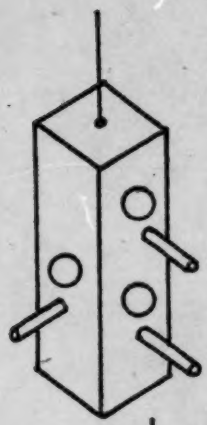
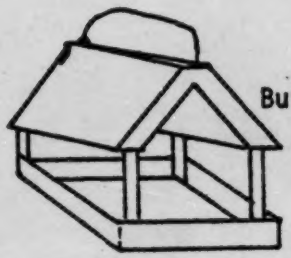
MASSACHUSETTS AUDUBON SOCIETY
LINCOLN, MASS. 01773



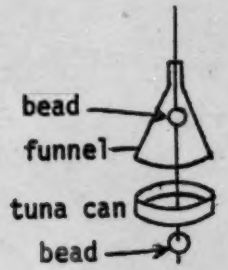
A simple box with a wire for hanging. Could be made from side of a half gallon milk carton.



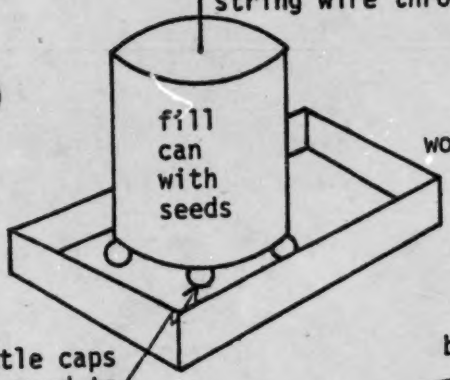
Block of wood, holes are filled with suet



Build from wood scraps



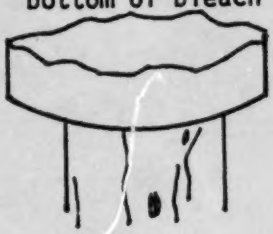
string wire through can and tray

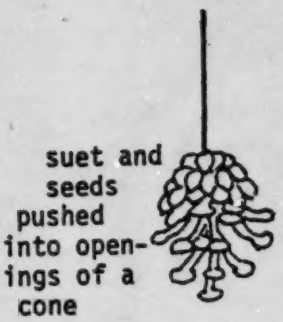


wooden tray works best

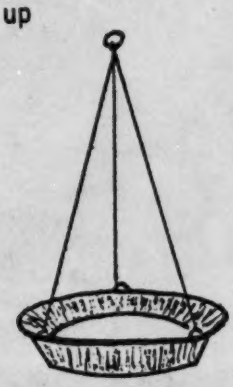
bottle caps or wood to hold can up

bottom of bleach bottle, nailed to a post

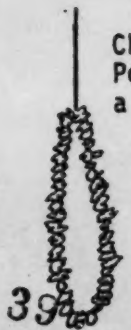




suet and seeds pushed into openings of a cone



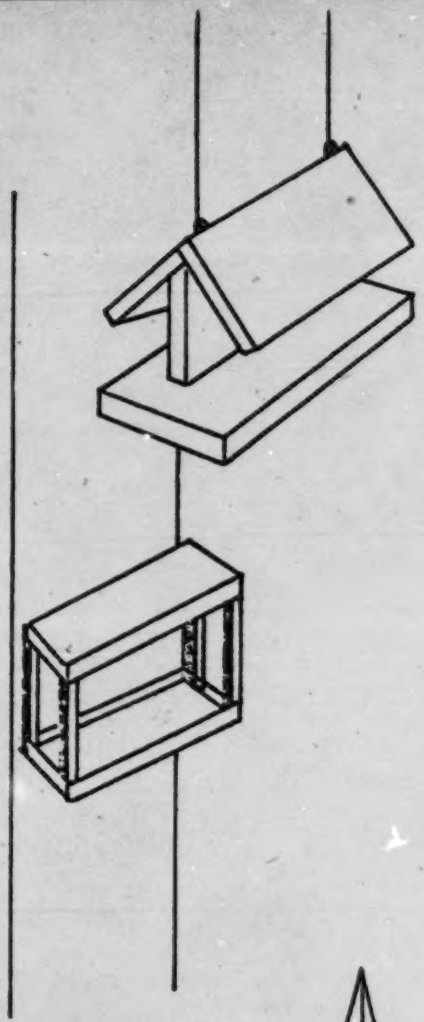
aluminum pie pan

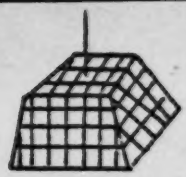


Cheerios or Popcorn on a string

Dip end of string in white glue and let it dry, it will easily go through Cheerios.

wooden bead



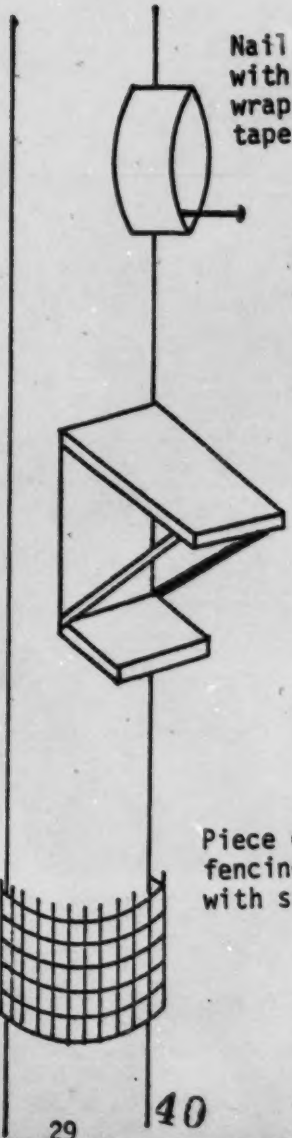


Hang any shape wire basket filled with suet or bread

Wooden feeders can be glued and nailed from scraps. (Scraps can sometimes be obtained from junior and senior high school wood shops.)

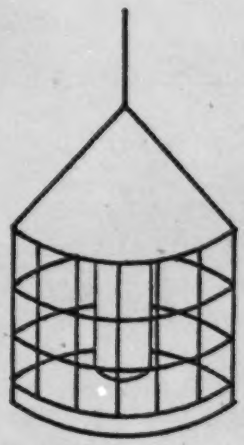
Log with holes

Leggs Container



Nail tuna can with long nail, wrap nail with tape.

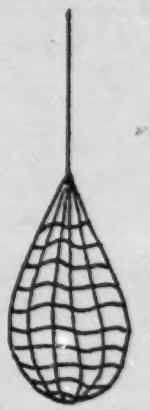
Coconut shell



Put fending around feeder so only small birds can get in.

Old basket

Piece of wire fencing filled with suet



mesh bag for suet

THE PARTS OF A BIRD

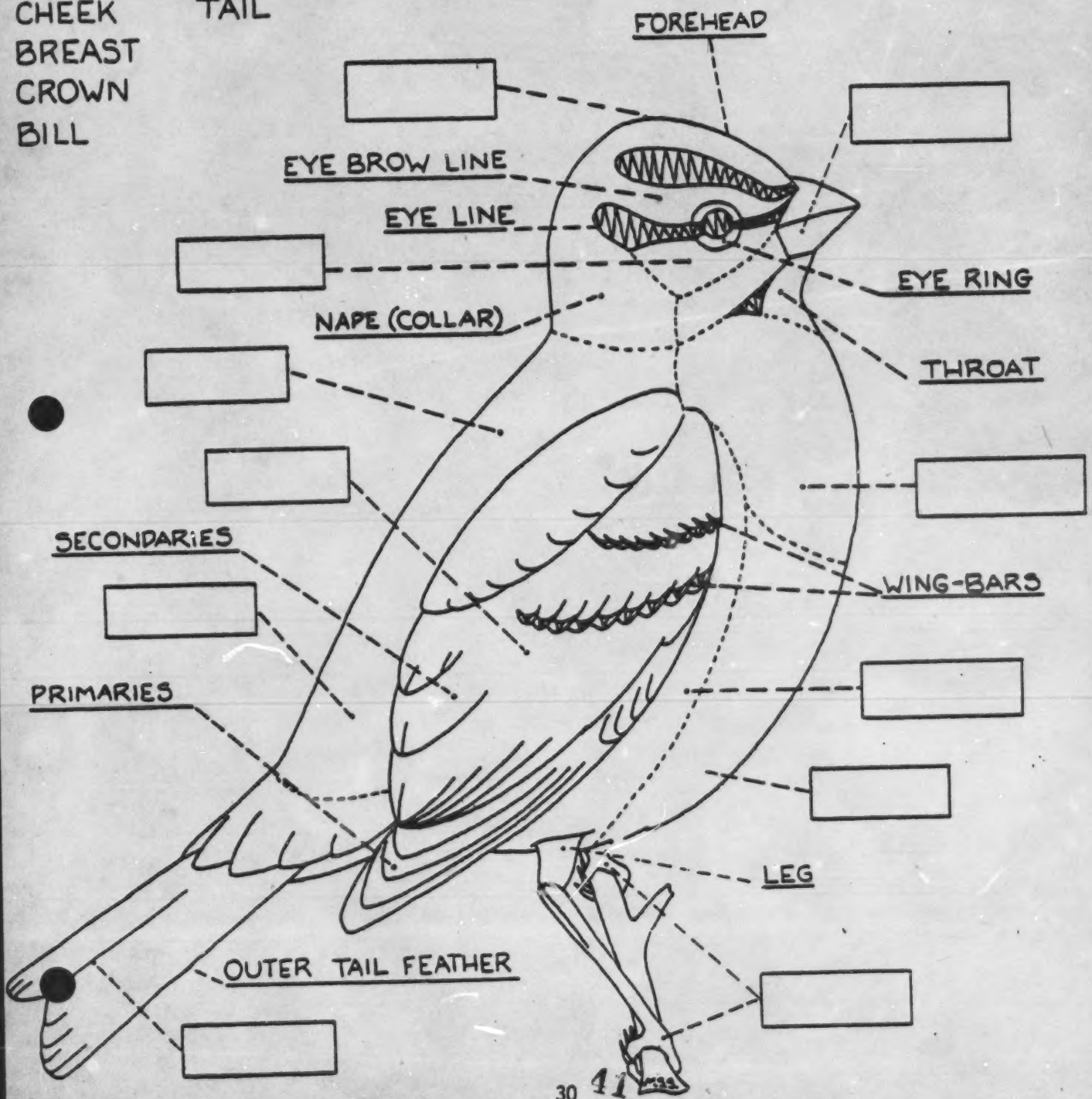
FILL IN THE BOXES

AND LEARN THESE PARTS

BACK
RUMP
CHEEK
BREAST
CROWN
BILL

SIDE
BELLY
TAIL

FEET
WING



MAS #18 MASSACHUSETTS AUDUBON SOCIETY Lincoln, Mass. 01773

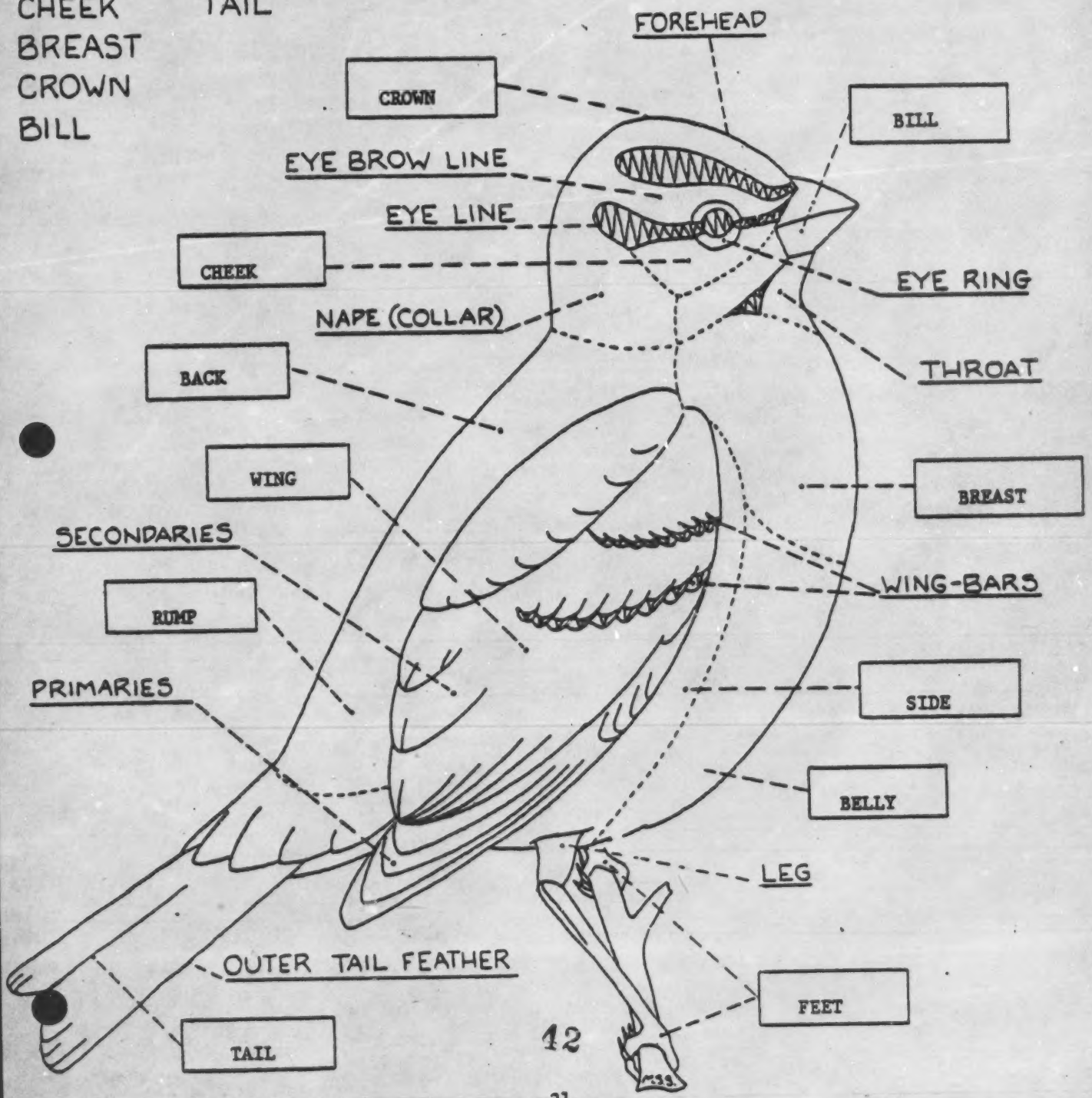
THE PARTS OF A BIRD

FILL IN THE BOXES

AND LEARN THESE PARTS

BACK	SIDE	FEET
RUMP	BELLY	WING
CHEEK	TAIL	
BREAST		
CROWN		
BILL		

ANSWER KEY



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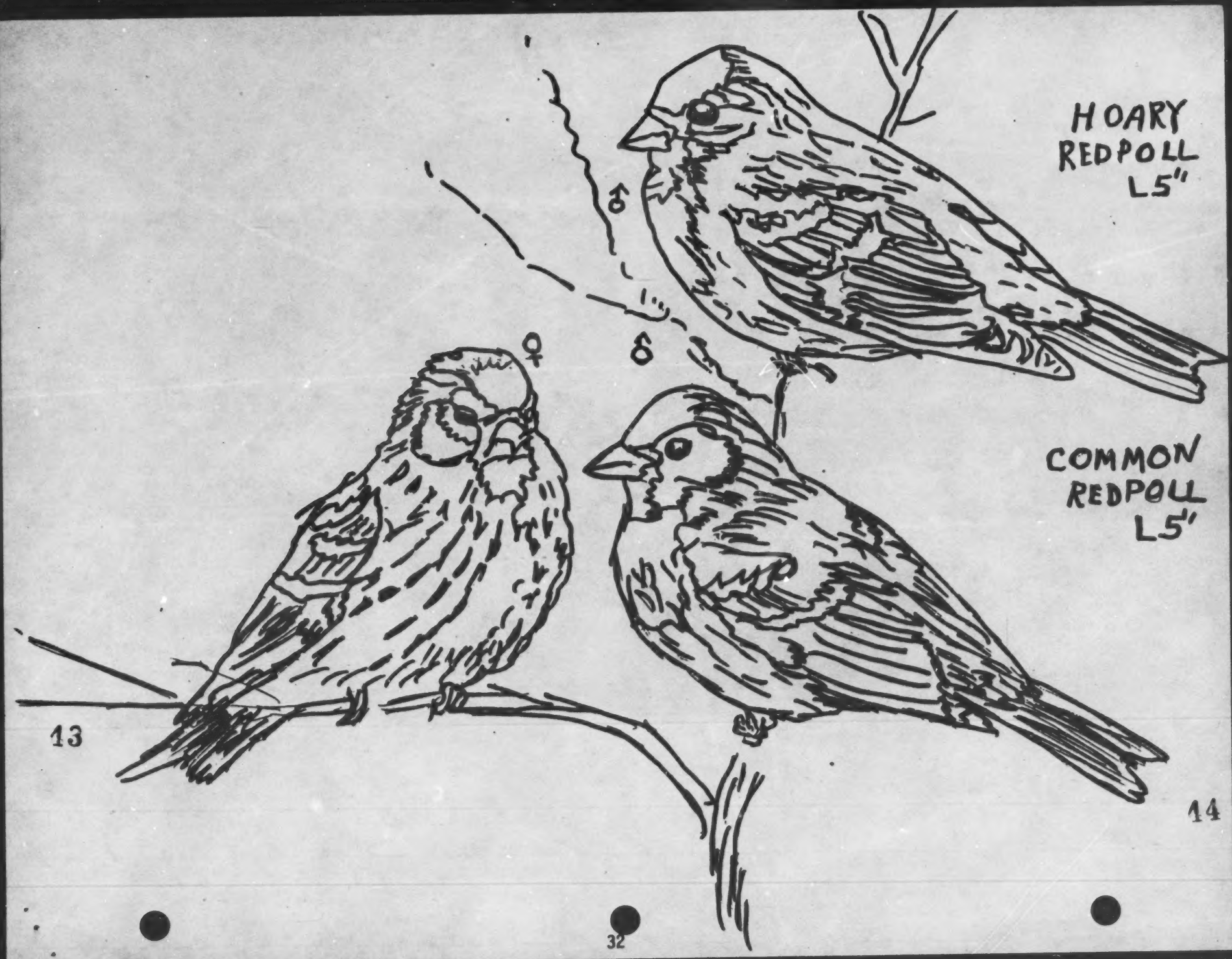
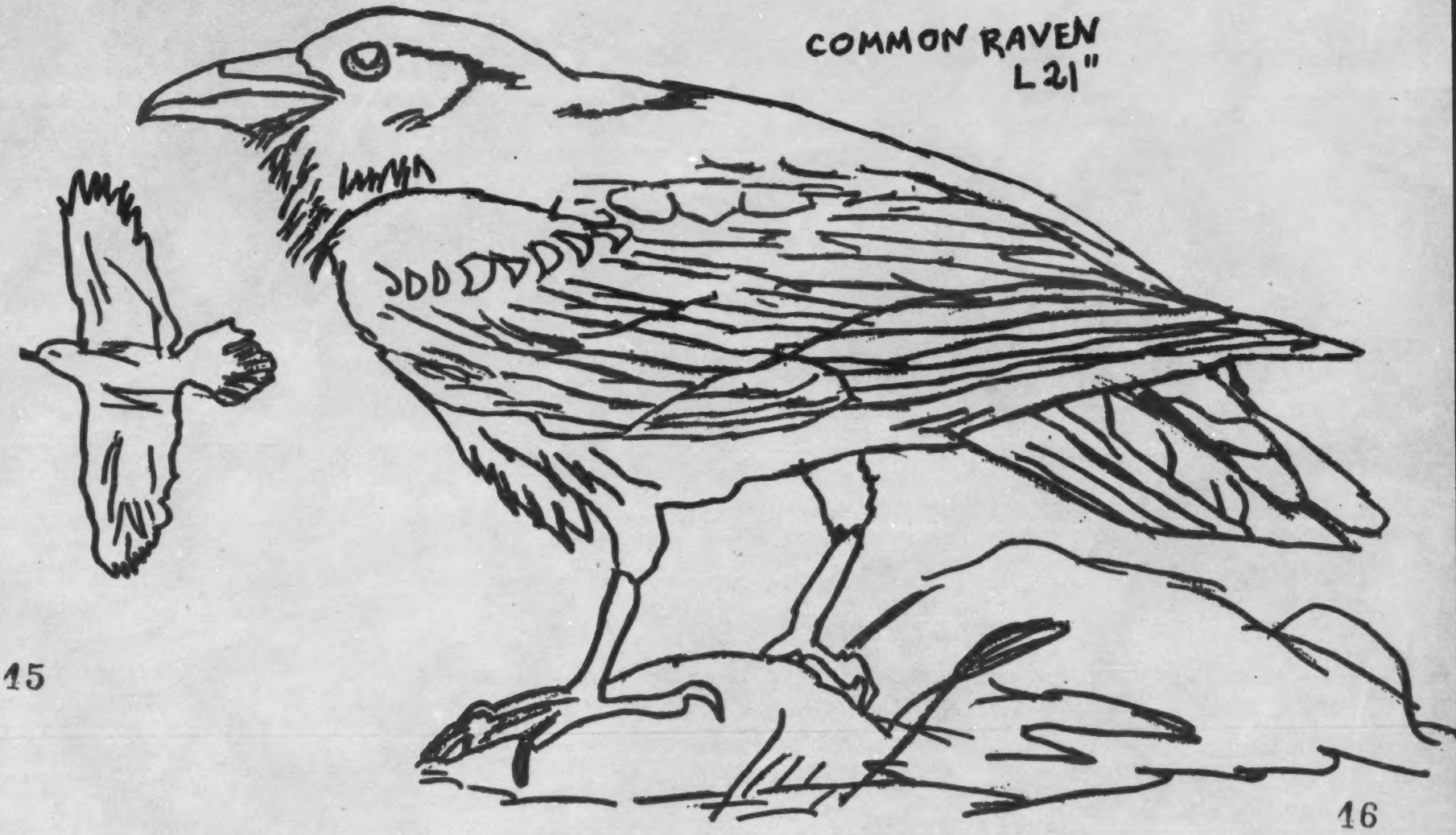

HOARY
REDPOLL
L5"
♂
1"
♂
♀
COMMON
REDPOLL
L5'
13
14



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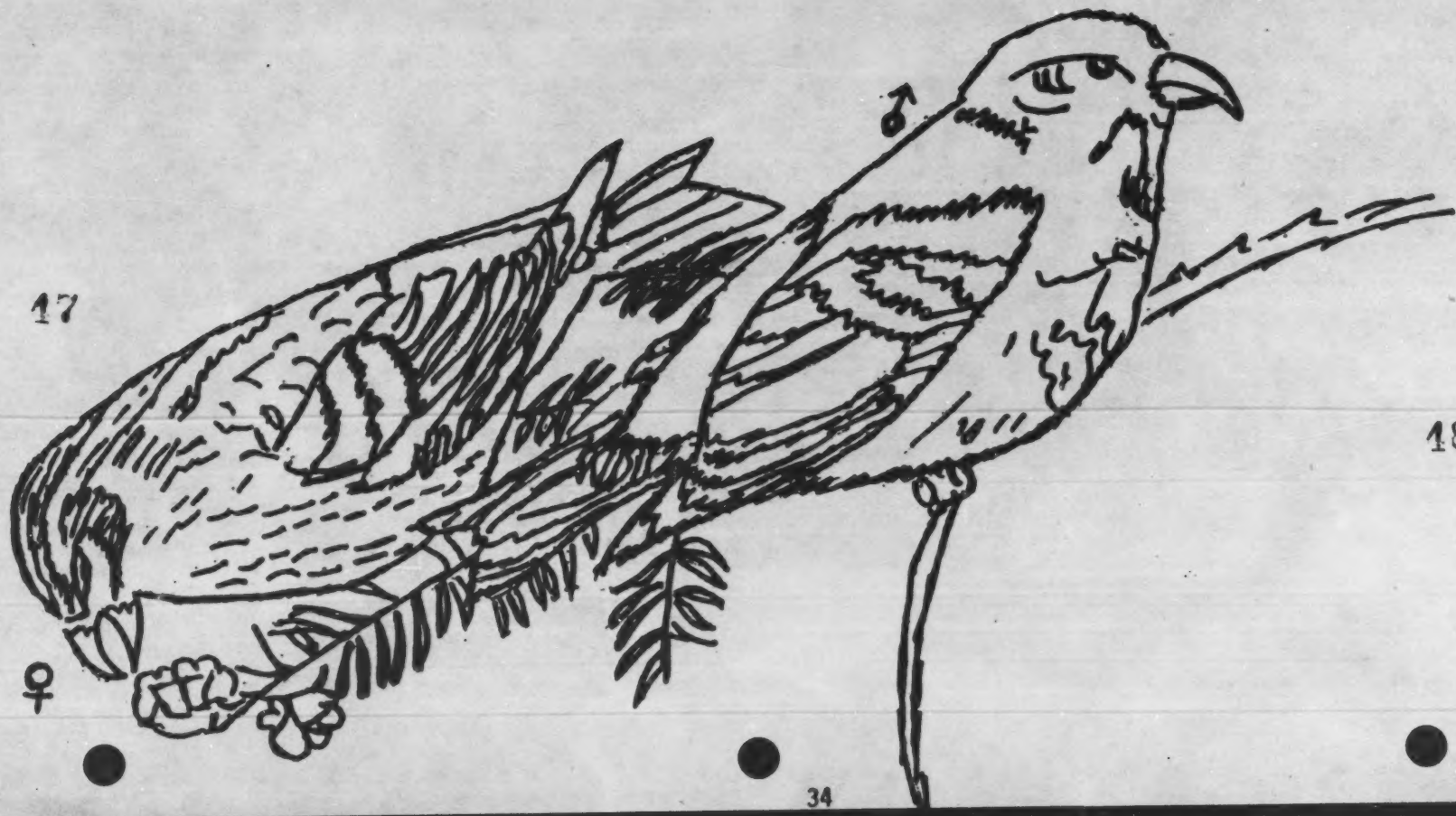
16

WHITE-WINGED CROSSBILL
length 5 3/4"



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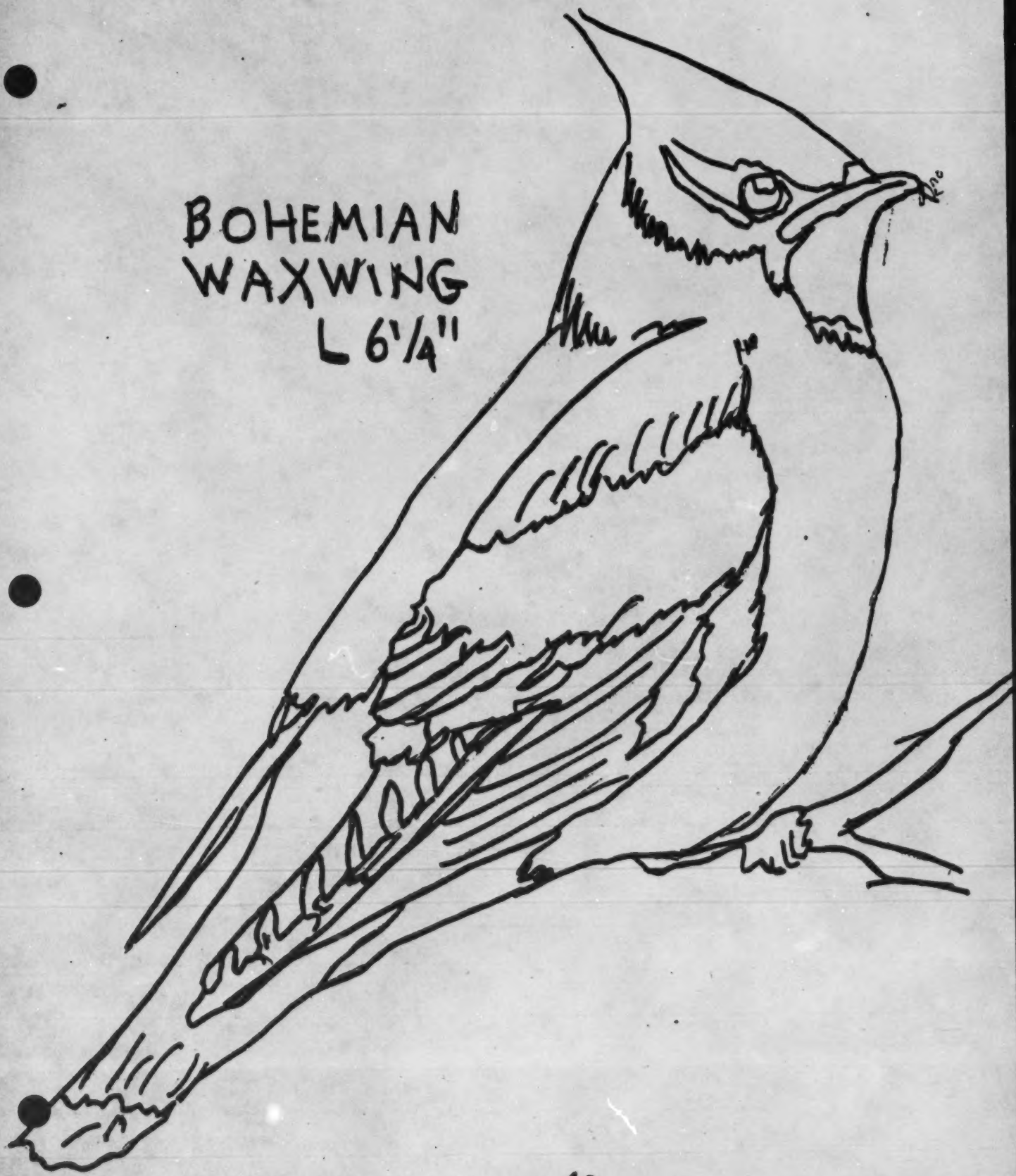
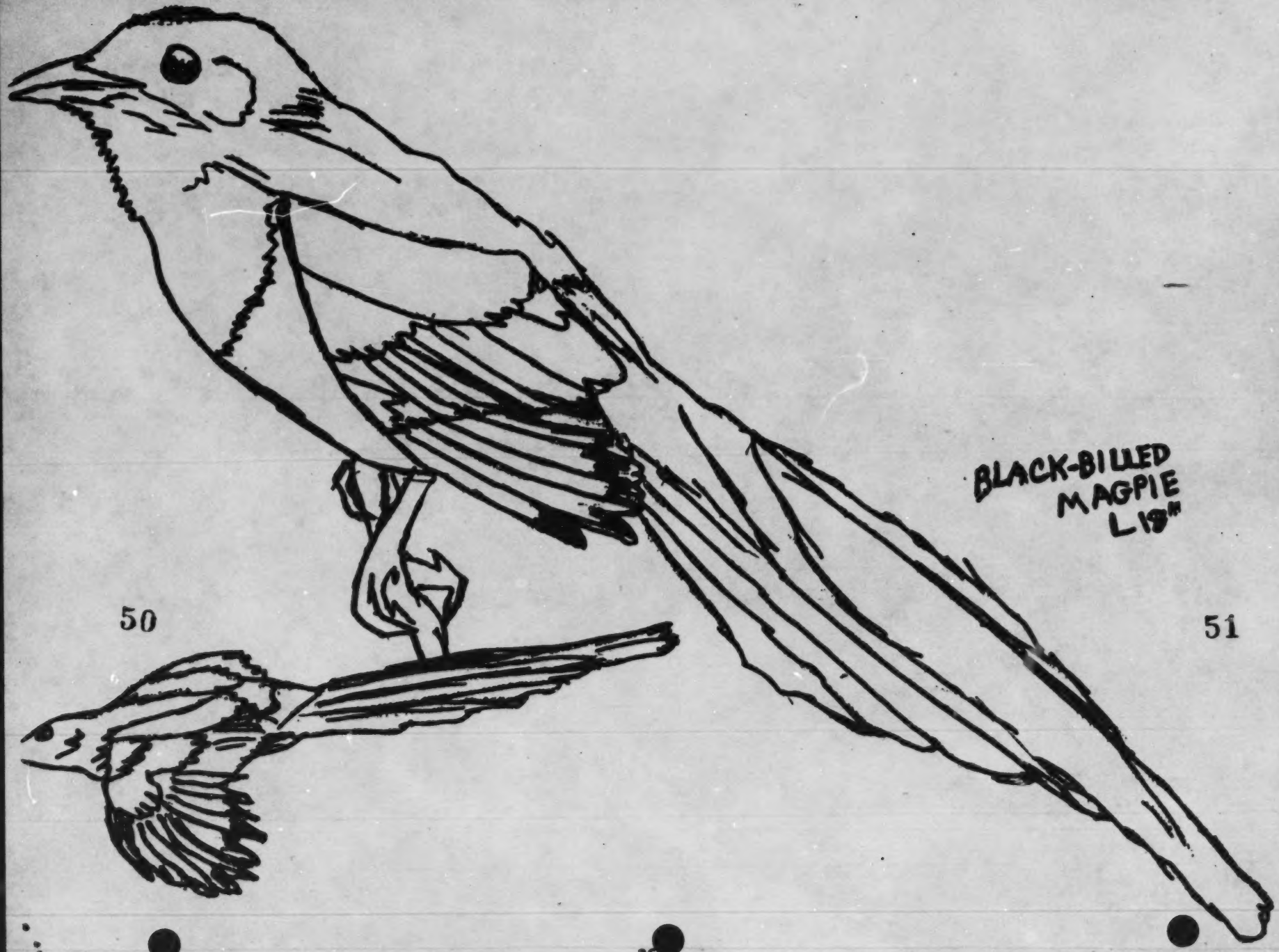

BOHEMIAN
WAXWING
L 6 1/4"



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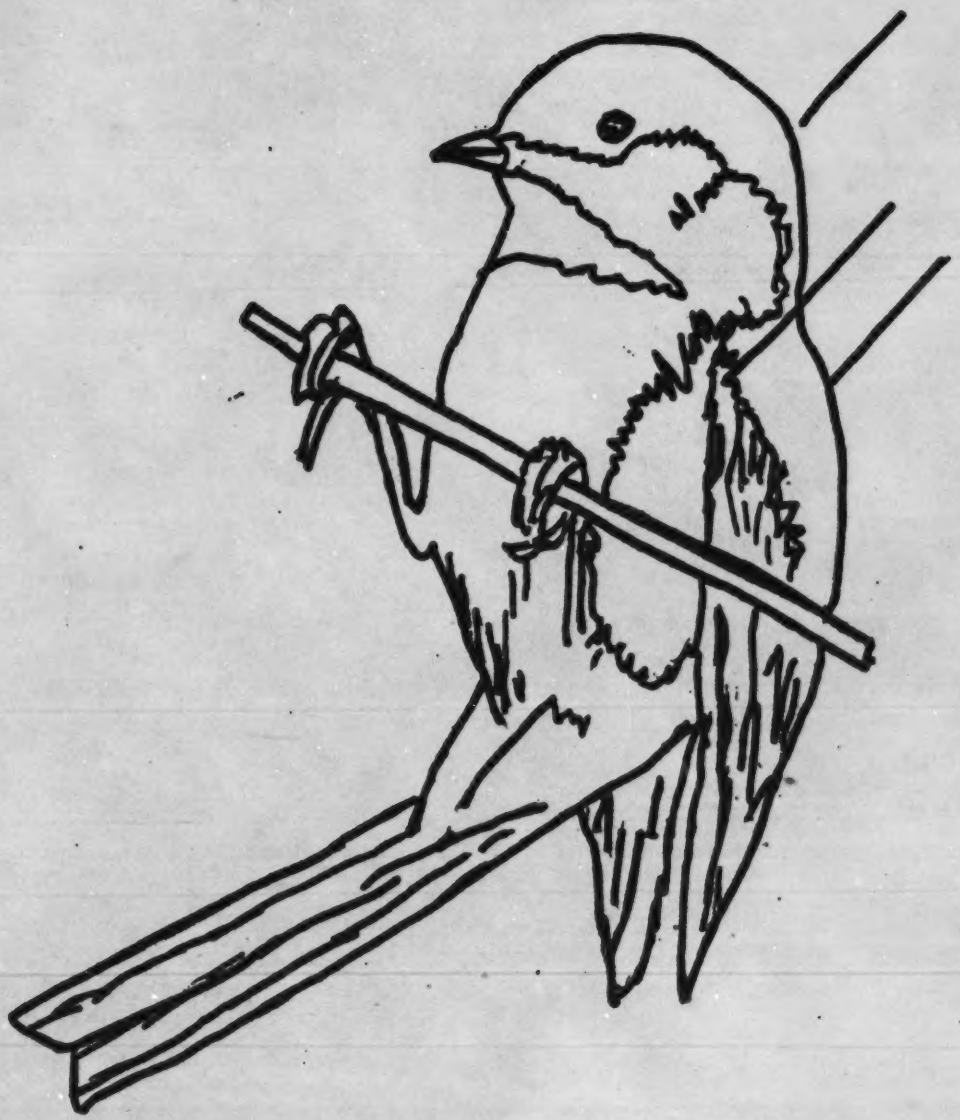


Black-Capped
Chickadee
L 4½"

S O U N D

Grade II

SOUND

Grade 2

MATERIALS

KIT

17	blindfolds
60	nails
35	filing cards
5	blank cassette tapes
1	tape "Sounds Around"
17	boxes
17	sound bridges
30	thin rubber bands
30	medium rubber bands
30	thick rubber bands
10	tuning forks
10	metal strips
1	box of rice grains
10	small drums
10	rubber mallets
10	plastic cups
	plastic bags

NON KIT

Sound makers
Paper and pencil
Tape machine
Aquarium

SOUND

Grade 2

SUPPLEMENTARY MATERIALS LIST

FILMS:

SOUND AND HOW IT TRAVELS -- 11 min. -- color F 701

BOOKS:

SOUND AND HEARING - Stevens
SOUND: AN EXPERIMENT BOOK -- Baer
JUNIOR SCIENCE BOOK OF SOUND -- Anderson
THE TRUE BOOK OF SOUNDS WE HEAR -- Pondendorf
SOUND -- Follett Series
HIGH SOUNDS, LOW SOUNDS -- Branely

MODEL:

EAR MODEL OR DIAGRAM

TAPES:

SCIENCE OF SOUND - (In Kit)

VIDEO TAPES:

VT 0106 - SOUNDS SERIES: THE MUSIC PLACE

VT 0135 - OSCILLOSCOPES AND THINGS SERIES: THE MUSIC PLACE

SOUND

Grade 2

Introduction:

Being able to hear sounds is very important to those, of us, who are blessed with this faculty. Yet our ability to hear is often taken for granted. It is difficult for most of us to imagine life without sound. Sound gives meaning to much of our day-to-day existence. Noises, loud, jarring and unpleasant, produce strong emotional responses and disturb our working efficiency. On the other hand, there are sounds which are pleasant to us.

It is with these things and others that this unit is concerned. In fact, it is the personal aspects of sound that make the unit an appropriate unit to study.

Listening to sounds is a very important way of learning about one's environment. Good listening skills are useful in observing, inferring, identifying. These processes in turn are important determinants of the persons behavior in his or her environment.

There is more to sound than just listening. It is important for your students to gain some understanding of the physical phenomena behind sound. Although you can, "learn with your students," perhaps you would like to have more background. Read as much of the following as seems appropriate.

Background:

Sound is Energy

Sound is one form of energy. It is produced by the vibration of matter and transmitted through matter in the form of waves (sound waves). Particular sounds can be loud or soft, high pitched or low pitched, depending on the energy of the source and the way the particular material vibrates.

The energy needed to produce sound may come from many sources. Electrical energy or energy of motion may be changed to produce sound energy. A drum is a sound radiator. It changes the energy of a moving stick into another form of energy (sound energy) that radiates into the air. This new form of energy produces the sensation of sound when it acts upon our ears.

The sound energy is transmitted from the drum to the ear by air molecules vibrating back and forth regularly in what is called a sound wave. The waves are similar to the wave pattern produced when a rock is dropped into a pond of water. If you were to look down you would see ripples. If you were to look from the side you would see a regular series of hills and valleys.

The crest (hill) of the wave is actually where the air molecules are being squeezed together and is known as compression. In the trough (valley) of the waves, the air molecules are moving apart (a partial vacuum is produced) and this is known as rarefaction. A sound wave is thus transmitted over distances without actually carrying air with it (only the energy moves, not the matter).

Sound waves are actually waves of energy which move the molecules in an object. Sound waves travel through any form of matter (solid, liquid, and gas). Sound travels through material that is denser (has more molecules per cubic inch) much faster than less dense material. For example, in air, sound travels 1130 feet/second, in water, 4760 feet/second, and in steel 16,400 feet/second (at 20°C). The more molecules available for transmission of the energy of sound, the faster the sound travels. Molecules must be present for sound to occur, therefore, no sound would be heard in the vacuum of space.

Sound possesses energy and is called a "form of energy". Just how little energy is involved is quite astounding. It has been shown that an orchestra of 75 performers, playing at their loudest, produces sound energy which, when converted into electricity, would only be enough to light a medium-sized electric lamp.

The energy contained in ordinary speech is also small. You would have to talk in a loud voice continuously for 45 minutes in order to produce enough energy to hoist a one-pound weight a distance of one foot.

Although sounds contain very little energy, their effects upon us may be very great. Have you ever been startled by a sudden blast of an automobile horn? Loud sounds, such as the car horn, evoke a feeling of fear and at the same time cause an increase in certain bodily activities. This is probably the reason that most people find a certain amount of noise mildly stimulating. However, too much noise will cause decreasing efficiency.

Properties of Sound

The properties of sound waves are determined by the source of energy which causes the vibrations, and the property of the materials which vibrate. Some of the properties used to describe sound waves are as follows:

Amplitude: One way of describing how loud the sound is or strength of the sound.

Frequency: The rate or frequency of vibrations per second (the higher the frequency of vibration, the higher the sound pitch).

Wavelength: The distance between adjacent crests or troughs, the distance from crest to crest or from trough to trough. The longer the wavelength, the lower the pitch; the shorter the wavelength, the higher the pitch.

The characteristics of musical sounds are pitch, loudness, and quality. Pitch can be used interchangeably with frequency which tells us how fast a material object is vibrating. The higher the pitch, the higher the frequency and the shorter the wavelengths. The lower the pitch, the lower the frequency and the longer the wavelength. Loudness is determined by the amount of energy producing the sound and is related to amplitude. Quality refers to the complexity of the sound wave pattern. To increase the quality of musical tones, various electrical equipment (amplifiers, stereos, etc.) can be used.

Resonance is a form of amplification. Sound waves are echoed back in time to add themselves to waves being sent in the opposite direction, making the sound louder.

Sound waves are measured in a unit called a decibel. A bel is ten times stronger than a decibel. Amplifiers are used to measure sound energy. 10 decibels = 1 bel.

Music

A noise consists of sound waves with a very irregular wave pattern. Musical tones have a very regular wave pattern and are usually quite pleasing to the ear. Muscial instruments have been designed in such a way as to enhance musical tones and the quality of sounds.

Musical instruments are divided into three general classes: the strings, winds, and percussion. In all three the vibrating object is

still the way a sound is produced. In string instruments the vibrating string causes the sound, which is reinforced by the resonating chamber of the instrument. As the string vibrates, standing tranverse waves result. The source of the musical sound in a wind instrument arises from standing longitudinal waves in the confined air column. The vibrating object is generally a reed or the lips. Percussion instruments consist of metal rods, plates, and sketched diaphragms. Their vibrations are produced by hammer-like impacts. Their vibrations are very complicated.

Musical Scale

In the history of modern music the standard pitch has varied so widely and changed so frequently that no set pitch can universally be called standard. However, for most purposes an object vibrating at 256 vibrations per second is denoted as Middle C. We can make this a standard for our purposes.

The diatonic musical scale, introduced in 1558, is based on harmonious tone intervals. This is the one scale most common to all of us. The harmony is based upon the frequency ratios between two or more notes.

Hearing and Speaking

The human voice has been called the most wonderful musical instrument; and yet the vocal cords seem to resemble most closely the simplest musical instrument, the drum. When we wish to speak, the vocal cords move together and form a narrow, straight slit through which the air passes. As specific amounts of air pass over and through the vocal cords, the characteristic vibrations pass into the nasal and mouth cavities. The sound vibrations are then "tempered" by movement of the tongue, teeth, and lips.

Now that the sound is produced, let us look at the method by which the sound can be heard. Probably you are aware that the ear is composed of three distinct parts: the outer ear, the middle ear, and the inner ear. The outer ear serves to collect and direct sound waves through the ear canal to the ear-drum. This is a tightly stretched, flexible membrane, approximately 3/1000 of an inch thick. It separates the outer and middle ear. In the middle ear we find three very small bones: the HAMMER, ANVIL, and STIRRUP. The hammer is attached to the eardrum. One end of the stirrup - like bone is fitted into a small opening in the inner wall of the middle ear called the OVAL WINDOW. Sound waves, striking the eardrum, cause it to vibrate and its vibrations are transmitted across the middle ear to the oval window. The oval window marks the beginning of the inner ear.

In the inner ear a fluid fills a spiral passage called the COCHLEA. Within parts of the cochlea are elongated cells (hairlike fibers) which respond to the pulsations in the fluid caused by movement of the oval window. Each hairlike fiber responds to a specific frequency. Nerve endings attach to these cells and send the message (sound) to the brain.

TERMS

Bel:	A unit used to compare the intensity level of sounds.
Beats:	The throbbing effect due to the alternate interference and reinforcement of sounds at different frequencies.
Reverberation:	A confusion of sounds resulting from reflection of sounds back and forth in a confined space without the production of echoes.
Frequency:	The number of cycles, waves, vibrations, or oscillations occurring per unit of time. If the unit of time is cycle/second, we use the term hertz as the unit. For example: 20 cycles/second = 2 hertz.
Longitudinal Waves:	Waves in which the vibrating particles move back and forth along the line of the direction in which the wave is traveling.
Transverse Waves:	Waves in which the vibrating particles move back and forth across the line of the direction in which the wave is traveling.
Pitch:	The sense of "highness" or "lowness" of a musical note that you hear.
Amplitude:	The strength of sound vibrations.
Doppler Effect:	The change in pitch of a sound due to motion of the sound source and the hearer relative to each other.

LESSON I - "A Silent Room?"

Concepts: To identify the location of various sound producing objects.
To make each student more aware of sound stimuli in the environment.
To demonstrate that sounds carry messages.

Preparation:

* You will need to tie blindfolds on each student at sometime during class. (Note: It will take some time to tie on each blindford and to quiet the class for the lesson. One student may assist another.)

** A number of "new" words will develop with this lesson. Some possible words are: sound, silence, listen, hear, loud, soft, high, low, long, short. You may want to list these on the board as they arise.

*** You will need to generate two sets of sounds. An overlap will involve all your children with some common sounds.

**** Divide your students into two teams.

Procedure:

(Lead-off question)

1. As you begin tying blindfolds on the students ask, "If a person could not see what could he or she do to locate something?" (Feel, HEAR, smell, taste). Try to focus students' attention on HEARING!

2. Have all the students sit quietly. Make a sound. Have the student who is blindfolded whisper what the sound was. Have the student, who can see, record the number of tries needed to get a right answer.

3. After four or five sounds have the students reverse the process. Use different sounds for the second group.

*Possible sounds are:

Clock ticking
Hallway door opening and closing
Tapping fingers
Feet shuffling
People breathing
Wood hitting
Paper sounds
Hitting a glass with a pencil
Dropping something
Running water
Ringing bell
Blowing whistle
Running water
Closing book

(Follow-up question) 4. After both students of each team have participated, put the blindfolds away. Ask, "Who got them all right with one try?"...two tries?...three tries? etc." (You will probably have several ties...these students are your "best" observers for <u>this</u> activity.)

(Discussion question) 5. This lesson may draw to a close by having a list made on the blackboard to show the variety of sounds heard or the teacher may encourage thinking and more responses with the following type of questions:

When are we more aware of what we hear?
Can we hear more than one sound at a time?
What were the loudest sounds we heard? The softest?
Are the sounds we heard the only sounds being made around us?

6. You may want your students to draw pictures of the sounds they heard.

Kit Materials:

17 blindfolds

Non-Kit Materials:

Sound Makers
Paper and Pencil

LESSON II - "How do We get Objects to Make Sounds?"

Concept: To identify conditions necessary for producing different sounds.

Procedure:

(Lead-off question)

1. Show the students a piece of paper (any smooth paper will work). Ask, "How many different ways can you make a sound with this paper?" After the students have made some suggestions, give each student a sheet and let each try making sounds.

*Some possible ways include:

a. crumple the paper into a ball
b. Let it fall
c. Rub it across desk with finger tips
d. Shake it
e. Blow across it
f. Tear it

2. Ask the class to be quiet. Pass out two nails and a filing card to each student. Ask the students to leave materials where you placed them.

(Follow-up question)

3. Ask, "Are the objects, on your desk, making sounds?" (no)

Ask, "How can we get these objects to make sounds?" (hitting...tapping...blowing against)

Ask, "What kinds of sounds can we get with these materials?"

4. After they have made all of the movements several times, ask them to place all the materials on their desks QUIETLY. Then ask them to perform the movements individually as the teacher asks, "When do the nails produce sound?" (When one moves.) "When do the pencil and the card produce a sound?" (When one moves.) "Will these things produce a sound if they do NOT move?" (No, not unless more complicated equipment is used.)

5. By the end of this lesson, children should be developing this concept: TO MAKE A SOUND, SOMETHING HAS TO MOVE.

Optional: Set aside a table for display of items which can produce sounds. Have students bring some items. Teacher should also have some; example: rhythm band instruments, etc.

6. As a concluding activity list a number of objects on the board and ask the children to name the part that moves to make a sound. example:

   1. Banjo. . . . . strings
   2. Drum. . . . . .skin
   3. Whistle . . . . . .
   4. Piano. . . . . .

Kit Materials:

60 nails
35 filing cards

Non-Kit Materials:

Pencils and paper

LESSON III - "Sounds of All Kinds"

Concepts: To recognize various sounds.
To recognize the action causing the sound.
To understand the action source causing a sound.

Preparation:

* You will need a cassette tape machine which can be used both as a player and as a recorder.

** Print the following words on the board: Car crash, explosion, jet airplane, lawn mower, dishes breaking, turkeys, geese and ducks, cow barn, dogs, baby crying.

Procedure:

1. Obtain a cassette tape machine. Play the tape entitled, "Sounds Around" for the students. The tape consists of three parts....specific sounds, with names.... specific sounds without names.
Each student needs pencil and paper.

2. After each sound, press the stop button, on the machine. Have the students guess what sound they think they heard. Turn on the machine and listen for the answer. There are 9 sounds for this section.

3. With the next section of the tape, different sounds will be heard, however answers are not given. The words you place on the board can be numbered. Have the students either write their answers on a piece of paper or list the number. The correct sequence of sounds is shown on the tape cassette.

4. Review the action source for each of the words you have listed on the board, example, drum.....skin moving, violin.....string moving, etc.

Optional Activity:

1. Divide your class into groups of 4 members.

2. Assign one of the story lines to each group and have the teams develop a tape drama.

* This can be accomplished in a variety of ways. One possible way is to allow one team to come in before school or stay in at recess or after school.

"OH, JOHNNY!"

Mother: "Johnny, time for lunch. And don't slam the door!"

Johnny: (Runs into the house and slams the door, stubs his toe, landing on top of the cat.)

Mother: "Oh Johnny, Johnny, slow down! Go wash your hands."

Johnny: "Sorry Mom." (Runs upstairs, fills the sink with water and decides to play for a while.)

Mother: "Johnny, what on earth are you doing? Your lunch is getting cold."

Johnny: "Coming Mom." (Runs down stairs, pretending he's an airplane, pulls out his chair and plops down.)

"Oh boy! My favorite lunch." (soup and crackers.)

Mother: "While you eat your lunch, I am going to the store. Clean up after yourself and be sure to stay in the yard until I get back."

Johnny: "Aw Mom, can't I come too?"

Mother: "Well, okay, but hurry up." (noisy eating, dishes clanking in sink, water running, door shutting, car starting.)

NON-VERBAL

Door shutting, footsteps on the stairs. Girl humming a tune. The sound of a ball bouncing, sound change as ball is bounced in different ways.

Ball stops. Big sigh, steps back up stairs, door slams, SILENCE.

GAMES TO LISTEN FOR

Hopscotch
Basketball
Jumprope
4-square

Gym rings
Wrestling
Matchbox cars in the sand
Gocarts in the gym

THE TREE HOUSE

Hammer and nails, wood, stick for breaking, rope.

Scene: Tapping sound of two hammers, sawing, wood being moved around. A boy and a girl.

Tina: "It seems like we have been working on this for hours."

Terry: "Yah! I hope we can finish so we can sleep out here tonight."

Tina: "I've got an idea."

Terry: "What?"

Tina: "We need more helpers."

Terry: "Maybe you're right. I'll go get Steve." (Footsteps climbing down a ladder and running away.)

Tina: (mumbling to herself.) "I'm going to ask my friend Christy". (Creaking sound as she goes down ladder and runs off.)

A few moments of silence.

Voices: (Laughing, running, sounds of boards being dropped on the ground.)

Terry: "I'll go up and drop the rope down, Steve. You tie on the boards and I'll pull them up." (Sound affects.)

Steve: "Okay, pull it up." (Rope is dropped and boards are pulled up and crash to the floor.)

Voices: (Girls giggling and talking as they near the construction area.)

Steve: "Terry, you didn't tell me you had 'girls' working here."

Terry: "Oh, Tina's okay, she can pound nails as good as I can, besides, her dad works for the lumber yard."

(Girls come up ladder talking and laughing.)

Tina: "Oh boy, Terry, with all these boards we can finish right away."

(Hammering, sawing - - - - - - - - Long silence.)

Chorus: "Sigh! Oh, it's beautiful! Let's go get our sleeping bags."

(Footsteps down ladder - then ----- CREAK, GROAN, CRASH!!!)

Chorus: "Oh! No!"

Silence.

Terry: "Would you all like to sleep at my house tonight?"

"Giggles"

Kit Materials:

5 blank cassette tapes
1 cassette tape - "Sounds Around"

Non-Kit Materials:

Tape machine

LESSON IV - "What Vibrates?"

Concepts: To understand that sound is produced by vibrating objects.
To understand that the faster an object vibrates the higher the pitch.
To identify conditions necessary for producing different sounds.

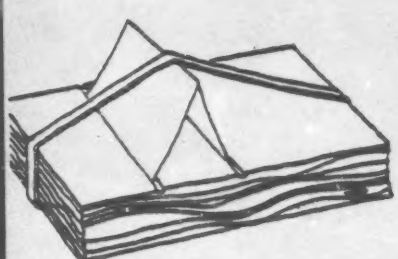
Preparation:

* Items from the materials list should be gathered for student team prior to the lesson.

** Questions for each team can be written on the board.

Procedure:

Team I. Rubber Bands



1. Team number I should have rubber bands of various thickness, box, wedge.
2. Team members should place a rubber band around the long end of the box...see diagram.
3. Next, have the student pluck the rubber band and listen to the sound.
4. Questions to ask:
   a. What makes the sound? (rubber band vibrating)
   b. How can you stop a sound? (keep the object from vibrating.)
   c. Which rubber band made the highest pitched sound? (1) thick band; (2) medium band; (3) thin band
   d. Which rubber band made the lowest pitched sound? (1) thick band; (2) medium band; (3) thin band
   e. What one thing effected the pitch of the bands? (1) color; (2) thickness; (3) length

Team II. Drums

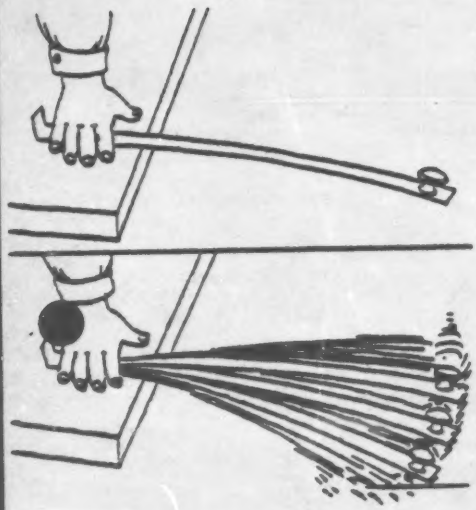
1. Team number II should have drums, grains of rice, mallets.
2. Team members should place a few rice grains on the top of the drum. (Hitting the drum surface hard will cause the rice to scatter everywhere!)

3. Have the students gently hit the drum surface. (see diagram)

4. Questions to ask:

   a. What happens to the rice grains when you hit the drum? (scatter over the drum)
   b. When you hit the drum hard, what happens to the sound? (gets louder)
   c. How do you make a soft sound on the drum? (barely hit it)
   d. Can you make different pitched sounds on your drum? (yes, hit near edge of drum)

Team III. Metal Strip



1. Team number III should have metal strips.

2. Team members should vibrate the metal strips on the end of their desks.

3. The length of strip extending beyond the desk will determine the vibrations, hence pitch of sound.

4. Questions to ask:

   a. What happens when you pull the strip down, then let it go? (it vibrates)
   b. How do you make a high pitched sound? (shorten the metal strip)
   c. How do you make a low pitched sound? (lengthen the metal strip)

Team IV. Tuning Forks

1. Team number IV will need tuning forks, mallets and water containers. Since some water may be spilled, have the students place newspapers on their desks.

Note! 2. The correct way to strike a tuning fork is to strike one of the prongs lightly with a Rubber Covered Mallet. Never strike a tuning fork with metal.

3. Give the team members some time to learn how to strike the tuning fork and place it in the water.

4. Questions to ask:

   a. What happens when you strike the tuning fork and place it in water? (water splatters)
   b. What causes this to happen? (vibrating)
   c. How do you make the tuning fork sound a loud sound? (hit it hard)
   d. How do you make the tuning fork sound a soft sound? (barely hit it)

Kit Materials:

10 boxes
10 sound bridges
30 thin rubber bands
30 medium rubber bands
30 thick rubber bands
10 tuning forks
10 metal strips
1 box of rice grains
10 small drums
10 rubber mallets
10 plastic cups

Non-Kit Materials:

Paper and Pencils

LESSON V - "High and Low Sounds" (This lesson is a review lesson from lesson IV)

Concept: To show that the PITCH of a sound made by a vibrating object depends upon several factors, including length of object and/or tension and thickness of the object.

Preparation:

* Same box used previously with rubber band stretched over it, with several rubber bands of varying sizes and thickness. Use rulers from students' desks.

** Questions will need to be written on the board.

Procedure:

1. Each pair of children should have the box with ONE stretched rubber band across it. They should also have several extra rubber bands as noted previously.

2. Review with the children the learning experiences in lesson III and IV (vibration). Not all the bands will produce sounds with the same pitch. Tell the children to pluck the bands (a small group at a time, or there will be too much noise to discern differences in pitch) and ask if they can hear any differences in the "high" or "low" quality of the sounds. Explain that the term for this is called PITCH. Most rubber bands will be pitched low but there should be some differences -- hopefully, enough for them to understand.

3. Tell the children they may now add the different rubber bands, one at a time, and determine how pitch changes, if it does at all.

4. After they have experimented on their own, present the following activities:

5. Stretch a THIN rubber band along side the thick one. Ask children to pluck them. Is there a difference in pitch? Which one is higher? Which lower? Press a ruler lightly on both bands a short distance from one end so that the length of rubber band that is vibrating is shortened. Have them compare pitches of the bands with the ruler on and off.

6. At this point you can go over the questions you have placed on the board. The students complete the questions independently with the boxes and bands at their desks.

7. With some groups, you may elect to guide the class through it as a group. The children should arrive at the conclusions independently, however.

8. Questions to ask:

   a. Which rubber band made the highest pitched sound? (1) thick band; (2) medium band; (3) thin band
   b. Which rubber band made the lowest pitched sound? (1) thick band; (2) medium band; (3) thin band
   c. What one thing affected the pitch of the bands? (1) color; (2) thickness; (3) length
   d. When you put the ruler on the bands, how did the pitch change? (1) became higher; (2) became lower; (3) stayed the same
   e. Question d, tells us that the pitch of a vibrating object is changed by the: (1) thickness; (2) color; (3) length of the object

Kit Materials:

17 boxes
30 thin rubber bands
30 medium rubber bands
17 sound bridges

Non-Kit Materials:

Paper and Pencils

LESSON VI - "Traveling Sounds"

Concept: To show that sound travels when a vibration is created in one location and reaches a receiver in another location.

Preparation:

* If you have a small transistor radio you may want to demonstrate sound traveling through water. See step number 6.

Procedure:

1. Ask children to close their eyes. Make a sound. Ask them to identify sound. Repeat with drum. (open eyes) Move to different locations in room. Produce same sounds. They should conclude that no matter what the point of origin in the room is, the sound still reaches them. Ask, "How does the sound get to your ears from the objects used?" Don't expect answer. Ask, "Can we hear the sound an object makes around a corner?" Let them speculate.

2. Call on one student to leave the room and go around a near corner (but leave the door open) and create a sound. Place another student in location in room. Instruct student to create sound, stop, and then repeat at intervals. The listener should raise his hand each time he hears the sound. Repeat with several pairs. Ask, "Can we hear the sound around a corner?" They should agree on "yes". Ask, "How does the sound go from the source to your ears?" "How does sound travel?" "How does sound go around a corner?" They may speculate on answers. Further investigation will lead to some conclusions. "Since we know that sound travels, through what substances will it travel?"

3. Recall with children the activity with sound "turning" a corner. Proceed with same activity except this time close the door. When the youngster returns to the classroom, the children can tell him how many times he made the sound. How did the sound get from the source outside to the ears of the children in the room? Can sound travel through a door or window?

4. Next, have one youngster at each table place his ear against the end of the table. Have the other youngster at the same table scratch his fingernail on the other end of the table. "Can you hear the sound? Through what kind of material did the sound travel to get to your ear?" Change places so other youngsters at table get a turn. They should conclude that sound can travel through wood.

5. Next, present the sounding object. Have it used somewhere in the room. Through what substance is the sound traveling? (Air) Is air solid like wood? (No) What is air? (a Gas) Did the vibration created by the sounding object travel through air? (Yes)

6. Fill the one gallon plastic container with water. Place a small transistor radio in a plastic bag. Turn on the radio. Close the plastic bag. Place the whole bag system in the water.

(Discussion)

7. Sound can travel through a liquid, a solid, a gas. Is there something through which sound <u>CANNOT</u> travel? (vacuum)

Kit Materials:

1 gallon plastic aquarium
plastic bags

Non-Kit Materials:

None

LESSON VII - "Other Experiments"

Concepts: Various concepts.

Preparation:

* There are a variety of experiments you might want to try with your students. Equipment items are not specifically included in the kit, for these experiments. However, the items are easily gathered.

Experiment A:

Have the students make paper megaphones both as loud speakers and as earphones.

Experiment B:

Obtain a large plastic ear model. Review the parts of the ear.

Experiment C:

Make a telephone line with two paper cups and a rubber band or string.

Experiment D:

Make various pitched sounds with air escaping from a balloon.

Experiment E:

Cut the bottom out of a paper cup. Wrap plastic wrap on top and fasten with rubber band. Talk through bottom and watch plastic wrap vibrate.

Experiment F:

Make musical instruments out of used Chlorox bottles; clothes hangers; wooden blocks; water filled glasses.

Experiment G:

Put various things in a plastic bag. Listen to the sounds.

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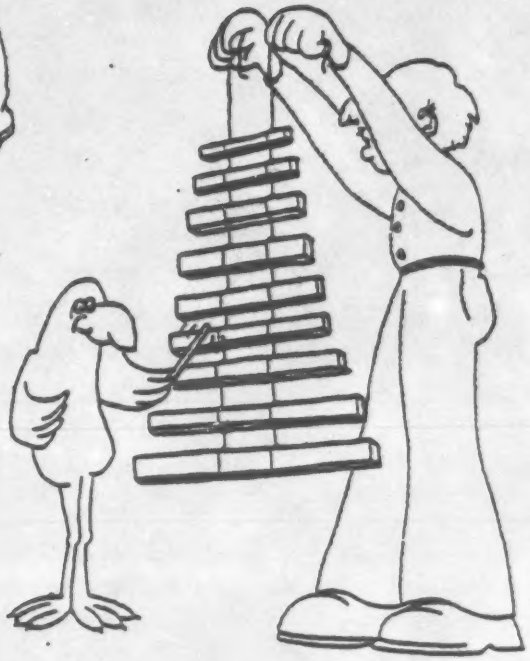


TEACHER'S RESOURCE BOOK

FOR

FORCE AND MOTION

GRADE 2

(Second Semester)

September 1978

Superintendent of Schools
Anchorage School District
4600 DeBarr Road
Anchorage, Alaska 99504
Telephone (907) 333-9561, Extension 231

A Program Development Department Production

FORCE AND MOTION

GRADE 2
(Second Semester)

KIT

1 blindfold
3 pieces construction paper - 1 red, 1 blue, 1 green
30 each - 1' x 1' squares: red, blue, green
15 clock faces
1 toy cart
120 marbles
30 meter sticks
student worksheet

NON-KIT

FORCES AND MOTION

Teacher Background

Grade 2
(Second Semester)

A stunting airplane hurtles itself towards the earth and then climbs upward again.---A car screeches to a stop.---A rocket, pushed skyward towards the moon, accelerates faster and faster.

It is with these things that this unit deals.

Force and Motion are two of the most important quantities necessary in all of science. The description and measurement of some type of force and motion is necessary in every branch of science. Consequently, we must make sure that we understand clearly how forces act, in relation to other forces and how motion generated by forces operate.

FORCES:

Forces are the pushes and pulls exerted on matter: the pull of a magnet on a pieces of iron, the pull of a child on a wagon, the push of a bat against a ball, the gravitational pull between the earth and all objects on or near the earth. A force has magnitude and direction, and an arrow is used to describe these characteristics. The head of the arrow points to the direction of the force and the length of the shaft represents its magnitude.

Forces always produce or prevent motion and are always accompanied by opposing forces or by forces arising from related events. In other words, a force can put in motion an object at rest, change the speed of the object and/or the direction of the object which already is in motion, or stop an object which is in motion. When two or more forces act on an object, it reacts as a result of the combined forces. (Two cars running together.)

Friction is a force which acts between moving surfaces. All moving objects on earth are subject to friction. Although the negative aspects of friction are frequently stressed, it should be remembered that the simple action of walking is impossible without it.

MOTION:

When you travel from home to school you undergo a change of position or what the scientists call displacement. You change your position on the earth's surface (relative position). Suppose you are asked, "How do you go from home to school?" and you answer, "I walk nine blocks." Obviously you have not completely described how you made your trip. You have mentioned how far, but not the direction. Thus, displacement must have both direction and magnitude.

Both direction and magnitude are relative quantities. One must always describe them in relation to something. For example - the watch hands move, due to a force. The hands have specific positions relative to each other and to the

reference frame, the numbers on the watch. The watch, furthermore, is in a motion relative to the background. We, as the observer, are reading the watch dial. Have you ever found yourself in the following conversation?

BILL: "Jim, do you see the blackbird sitting in that tree over there?"

JIM: "What blackbird?" "In which tree?" "Where?"

BILL: "In that big, scarred tree over there." (Pointing his finger).

JIM: "Oh, that tree in front of us! I see it but I don't see the blackbird."

BILL: "On the branch," etc., etc.

As you can see, before a line of communication could begin, a frame of reference had to be established.

SUGGESTIONS AND ANSWERS:

This unit would perhaps best be suited for early spring! The Highline teachers have had more difficulties with this unit than any that have been written. We will promote the unit because it is very important in the sequence of science kit topics. The unit has been rewritten twice to accommodate their suggestions and has been tried successfully by second grade teachers. We will continue to evaluate and change the unit and solicit your comments.

Part of the problem in using the unit has been the teacher's inability to understand the importance of the unit and just what the unit is all about. A second problem has been the reading level of the worksheets. For this reason we are suggesting you wait until the spring of the year to run the unit. An alternate procedure would be to verbally do the whole unit with the class.

INTRODUCTORY COMMENTS:

A child becomes aware of motion very early in life and soon (intuitively) learns that motion can occur at different rates. "Move your chair." "Hurry up!" and "That is a fast car", are all expressions children hear at an early age. In this unit the child will be guided to look more carefully at such motion. Worksheet Number 1 is designed to introduce this.

The unit introduces the child to relativity (particularly relative motion). Although this concept is sometimes regarded as difficult, each of us uses it everyday. Whenever you describe a motion or position, you are using relativity. For example, when someone asks: "Which is Mary's desk?" You might say: "The third desk in the second row." In this example you are locating the desk in relation to other know objects. Or you might say: "She sits in front of me." Now you are locating Mary relative to yourself.

A similar situation is true with motion. You tell a child in a moving bus to sit still. He can sit still only relative to those who are riding with him. But can he be still relative to someone standing on the ground outside of the bus? Or, relative to the earth speeding through space, etc.?

Neither position nor motion can be described except relative to something else. This basis for describing position and motion is commonly called the FRAME OF REFERENCE. If you doubt the necessity of FRAME OF REFERENCE, try describing either position or motion without it.

Relativity implies that there may be more than one "correct" answer, depending upon the frame of reference, and thus encourages explorative and creative thinking.

For the greater part of this unit, the students work with objects. They observe them using various frames of reference. Two major understandings exists for the unit:

1. Motion occurs when a body changes its position relative to a chosen frame of reference.

2. Direction of motion is described with respect to a chosen frame of reference.

LESSON I: BECOMING AWARE OF MOTION

Objective: To discover through observation that motion is relative to the position of the observer.

Purpose: To become aware that things move.

Procedure: After getting the students attention, express to them the idea that for the next few minutes they are going to look very carefully at things around them. They are to pretend that they are all alone in the room. No one else is there. It is just as if they were the first one in the room in the morning. Have them look around. List all of the things that are moving. After about 3-5 minutes, go over the lists and see what ideas they have.

WORKSHEET #1 Example Answers:

1. The hands of the clock
2. The fish in the aquarium
3. The shadows
4. Specks of dust

Materials:

KIT	NON-KIT
None	Worksheet #1

WORKSHEET No. 1

Which Things Are Moving?

Pretend you are alone. No one else is in the room.

Look around you. Which things are moving?

LESSON IA: INTRODUCTION TO POSITION

Procedure:

1. Begin by asking the class where various objects in the classroom are located. "Where is the door?" "Where is the light switch?" "Where are you?" The children may reply by pointing to the object, by describing its position relative to other objects, or by describing its position relative to themselves.

   Now select an object in the classroom and report its position. For example, "The object I am thinking of is behind me and to my right. It is between the door and the chalkboard. It is above the pencil sharpener." The children are to try to find the object from your description. Let some of the children give descriptions of positions of other objects or systems in the room while the rest of the class tries to locate them.

   Or: One child selects an object in the classroom and the others ask him questions about its location. For instance, "Is the object behind you? Is it between the clock and the flag?"

Game: Where is the object?

2. In addition, play the game, "Where is the Object?" One child is selected to be the detective and leaves the room. The class hides an object somewhere in the room. The detective comes back and tries to identify the object by asking the class yes or no questions about the position of the object. You may want to limit the number of questions the detective may ask, or you could have an ongoing contest to see who can be the best detective by counting the number of questions each detective asks before he identifies the object. The detective who identifies the object by asking the least number of questions wins the game.

Game: "Blindman Statue"

3. The children have used themselves as well as other objects in their environment to describe the position of various objects. In order to make them more aware of describing the position of objects relative to themselves, play the game "Blindman Statue."

   One child is picked to be the Blindman and is blindfolded. The class secretly selects an object in the classroom, and the Blindman is placed near the object. The Blindman is not to walk but must remain a "statue". He may only move his arms and fingers. The Blindman is to try to point toward the object selected by the class. The class is to give instructions to the Blindman to move his arm in the direction of the object. They may also give an approximate distance. After the class has given the instructions, the blindfold is taken off and the Blindman is to guess which object the class has chosen.

LESSON IA: INTRODUCTION TO POSITION (continued)

If the children describe the position of the object relative to other objects in the classroom, they will discover this kind of instruction is of no help to the Blindman who needs descriptions of the object's position which are relative to himself.

Materials:	KIT	NON-KIT
	1 blindfold/class	None

LESSON IB: INVENTION OF RELATIVE POSITION

Procedure:

1. To introduce the idea of relative position, select several objects in the classroom and ask children to describe where they are. Point out that each answer describes the position of the object relative to some other object. Write a question about the descriptions on the chalkboard. If, for example, you ask about the position of the flag and John answers, "The flag is to the left of the door," then write, "What is the position of the flag relative to the door?" If Mary reports that, "The lamp is there" and points with her hand, then erase the words "flag" and "door" and write "lamp" and "hand" in their place. The question will then read, "What is the position of the lamp relative to the hand?" Point out to the children that the objects they use to help describe the position of other objects are called reference objects.

   Continue the discussion by selecting or having children select objects and reference objects while other children describe the position. You can do this by inserting new words into the sentence on the chalkboard or by exchanging the places of the two key words such as "lamp" and "hand": "What is the position of the hand relative to the lamp?" Explain that the answers to the question are descriptions of the relative position.

   To illustrate the use of the personal reference frame, give several examples describing the position of an object relative to yourself by naming the direction and approximate distance from you. Be sure you do not mention any other objects in the classroom. Then write on the board "Can you describe the position of an object relative to yourself?"

   Have a child describe the position of a system you select. Ask him to describe the position of the object relative to himself. Select objects that are in different directions from the child (e.g., behind, above). Remind the child not to mention any objects other than the one selected. Repeat this activity with other children and other objects or systems.

   A variation of this activity involves selecting a system and asking a child, "How do you have to stand, so the _____ is to your left and behind you?"

LESSON IB: INVENTION OF RELATIVE POSITION

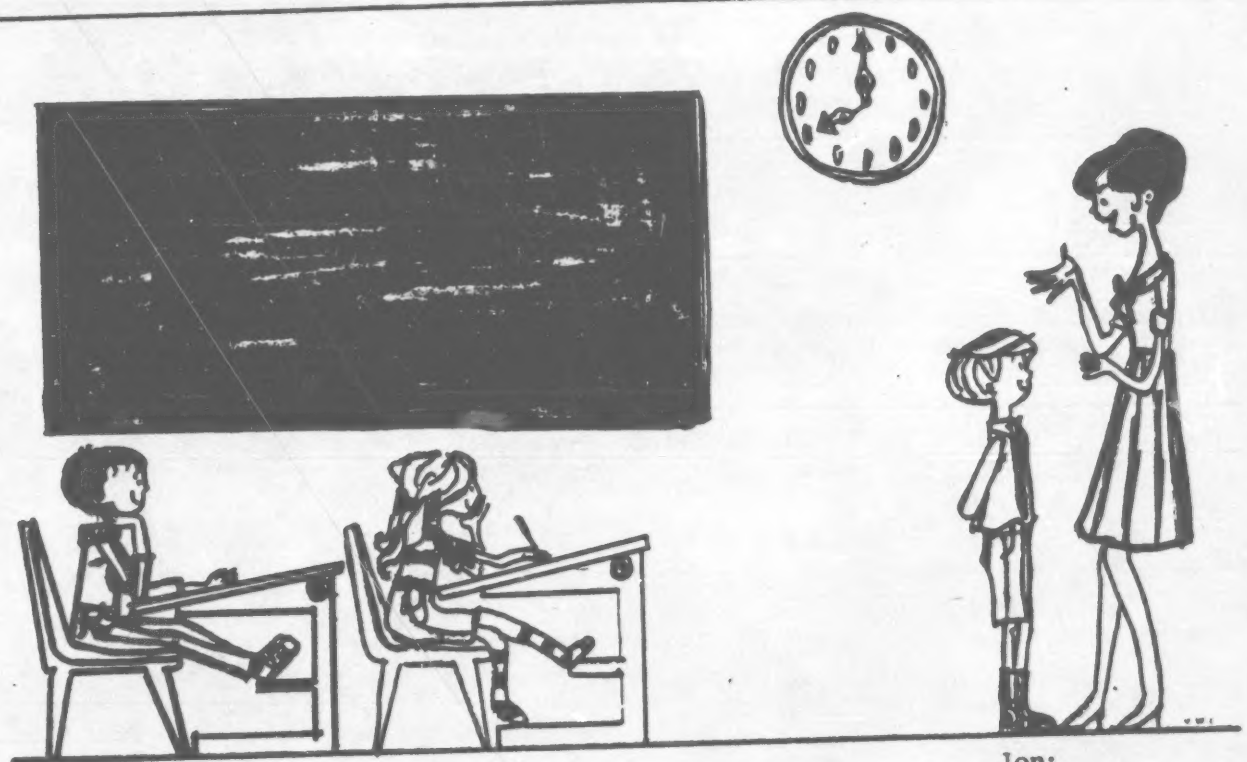
2. Now show the children how you can describe the position of an object by naming the direction and distance from other objects nearby. Select a system and describe its position relative to another object in the room without mentioning yourself. For example, "The map is one foot above and to the right of the chalkboard." Continue by asking the children to select a system and describe its position relative to other objects nearby. Discuss the advantages and disadvantages of the various descriptions.

3. Now read page 1 of the student manual. This page helps reinforce the invention of the term "relative position." Discuss the text and the picture. You might ask these questions: "Which child is describing the position of an object relative to other objects nearby?" "Which child is describing the position of an object relative to himself? "Which child is describing the position of an object relative to himself and relative to other objects?"

4. Continue by having the children read and do the work on pages 2 and 3 in their student manuals. On these pages the children are given more examples of how the position of objects or systems may be described relative to an individual or relative to other objects in the environment. The bridge and spider are to be drawn in the pictures by the children. The questions on the bottom of page 3 are to encourage discussion.

Materials:	KIT	NON-KIT
	None	Student Manual Sheets Pages 1, 2, 3.

These children are telling about the position of objects in their classroom.



Herbert:

"The clock is on the wall."

Lisa:

"The clock is above and in front of me, near the chalkboard."

Jon:

"The teacher is in front of me."

Can you tell or report about the position of some objects in the picture?

Where is Lisa's chair?

Where is Jon?

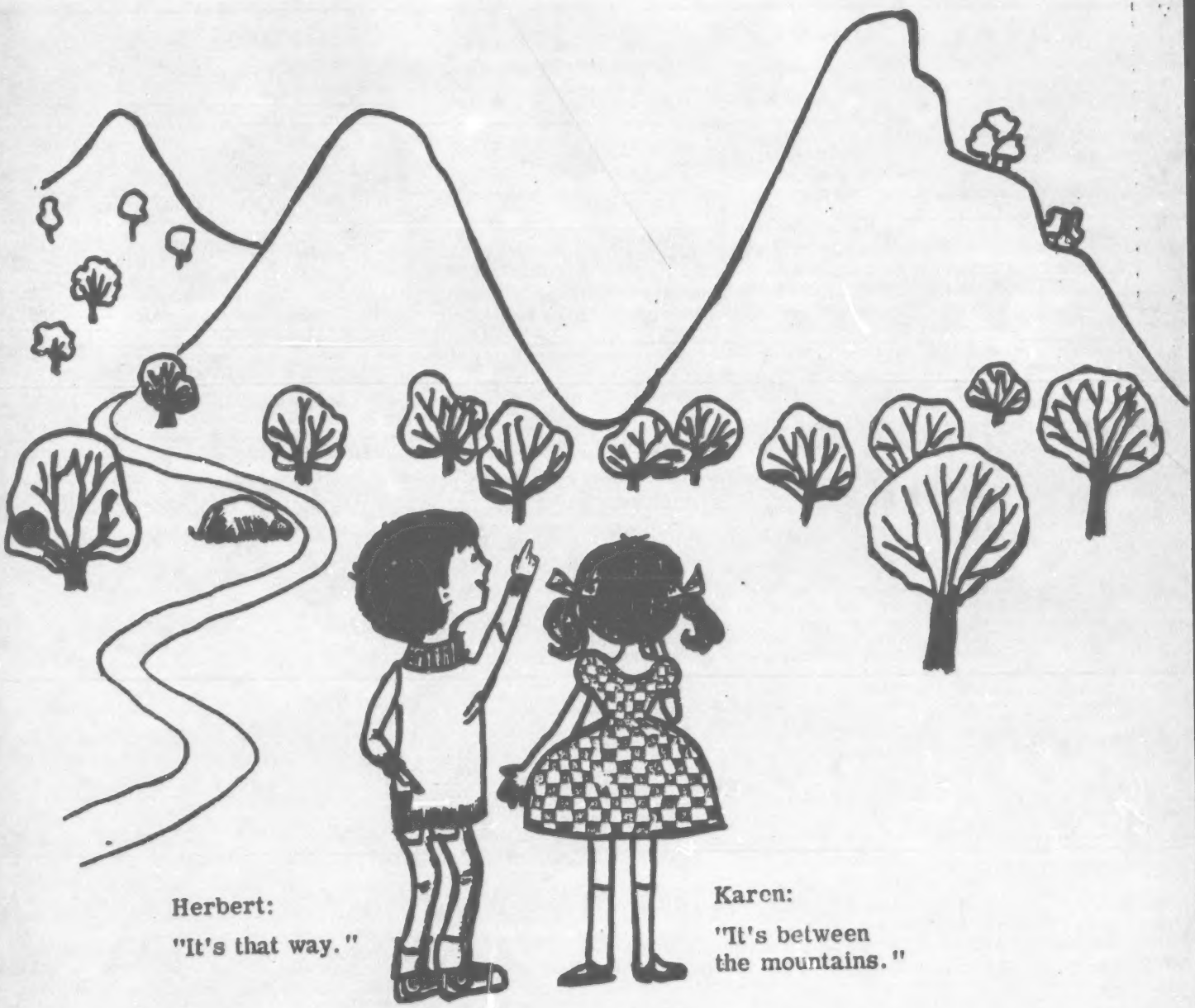
When you think of where an object is, you think of its position relative to other objects.

Where is the chalkboard relative to the clock?

Where is the chalkboard relative to Herbert?

Where is the chalkboard relative to Jon?

Herbert and Karen are reporting about the position of a bridge.



Herbert:
"It's that way."

Karen:
"It's between the mountains."

Where is the bridge?

Draw the bridge in the correct position.

Herbert, Bobby, and Ruth are reporting about the position of a spider.

Bobby:

"It's in the middle of the lower right window

Ruth:

"The spider is on the lower left widow

Herbert:

"It's in front of my nose."

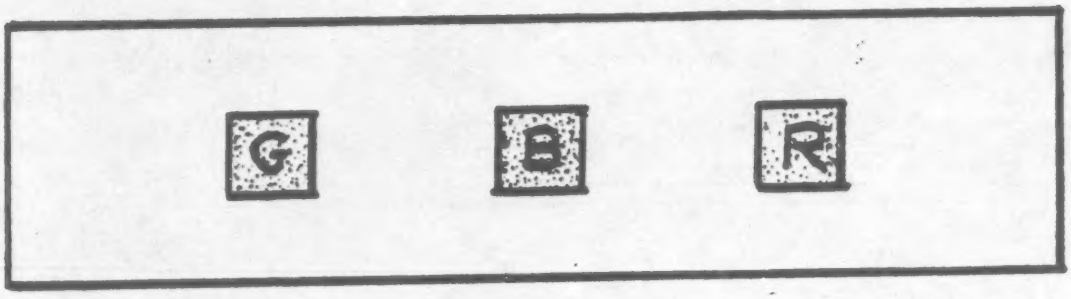
Where is the spider? Draw it in the correct position.

Whose report helped you the most? Why?

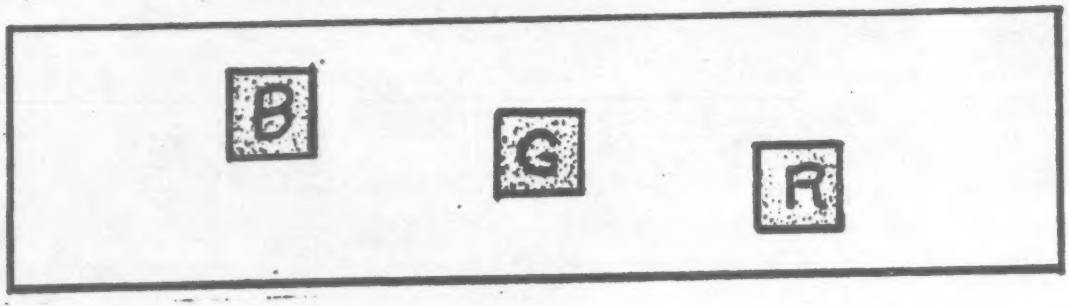
LESSON II: DIRECTION

Purpose: To observe that the motion of an object depends on where you look from.

Procedure: Part I. Put the large colored shapes (construction paper) on the chalkboard in the order shown. Move the Blue one down, the Red one up, and the Green one to the left. Notice on Worksheet #1 what the students are to do.



Now put the colored shapes in this pattern.



Move the Blue one right, the Green one down, and the Red one across to where the Blue one was at the start. Again, refer to Worksheet #2 for the students' work.

WORKSHEET #2:

1. You will note that the level of sophistication increases with this level. The students, in this lesson, will be asked to operate on something as well as describing it. Remember, if there is a reading problem in your class, go through it orally with the whole class - discussing as you proceed.

2. Answer: No.

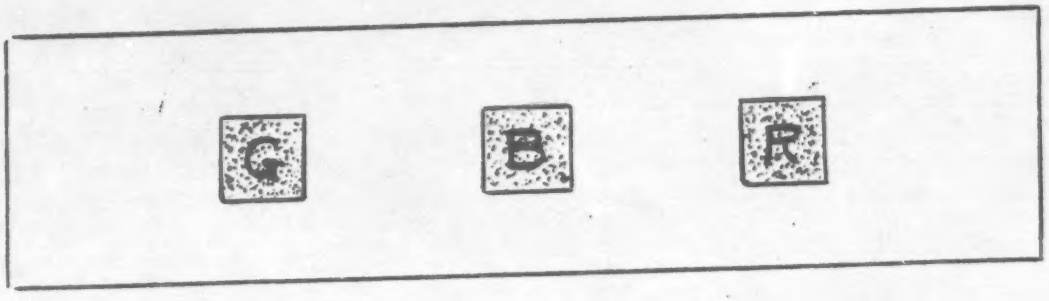
LESSON II: DIRECTION (continued)

3. The use of the arrow to show direction should be introduced at this time by means of discussion. The questions to ask are: "Which way does the head of the arrow point?" "In which direction is the thing moving (going)?" "From which direction did it come?" etc. The key to the child's understanding is the word "direction".

Materials:	KIT	NON-KIT
	Colored Shapes	Worksheet #2

WORKSHEET NO. 2

Look at the colored shapes on the chalk board. They are placed in the same positions as the shapes in the picture.

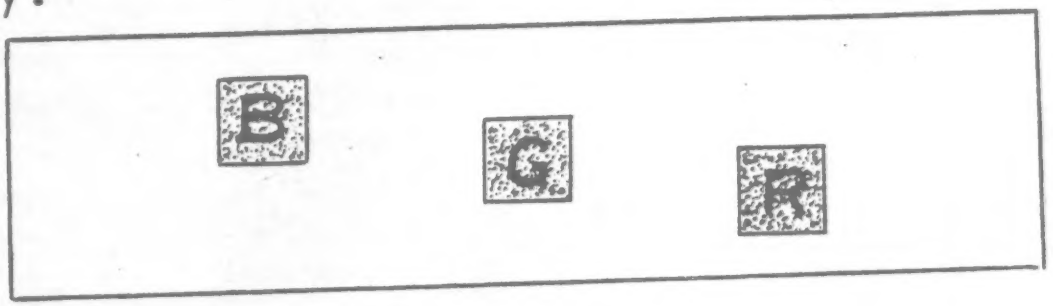


Your teacher will move some of the shapes. Show how the shapes were moved. Draw red arrows on the picture to show the direction each shape was moved.

Were all shapes moved the same direction?

YES NO

Start again with the shapes placed this way:



WORKSHEET NO. 2 (Page Two)

Your teacher will move the shapes.

Show how the shapes were moved. Draw red arrows.

Now show how you can move the shapes back to the first places in the picture. Use black arrows to show how to move them.

LESSON III: DIRECTION

Purpose: To discover that motion depends on where it is observed.

Procedure: Pass out the worksheets. Have students follow the steps. You will probably need to help the slower ones.

WORKSHEET #3

1. If you feel your class needs to review left and right do so before starting this worksheet.

2. In this lesson:

   a. Have students write the letters A, B, C, D, on each of his sheets according to picture on page 7A.
   b. Students should number their sheets 1, 2, 3, 4.
   c. Each student places sheet #1 on his desk with the "A" close to him and centered directly in front of him. He then lines up the clips from "D" to "B" (Red next to B, Green next to D).
   d. Each student moves his blue chip away from himself, toward "C". He records what he sees by drawing an arrow on sheet #1 to show the direction in which motion occurred.
   e. This process is repeated on pages 8-10.
   f. Pages 11-13 statements refer to pages 7A-10.

Materials:

KIT

30 each - squares construction paper
1" x 1"
Red
Blue
Green

NON-KIT

Worksheet #3
4 sheets paper per student

WORKSHEET NO. 3

You have 4 sheets of paper. You will use them to find out more about direction.

Write the letters "A", "B", "C", "D" on each sheet.

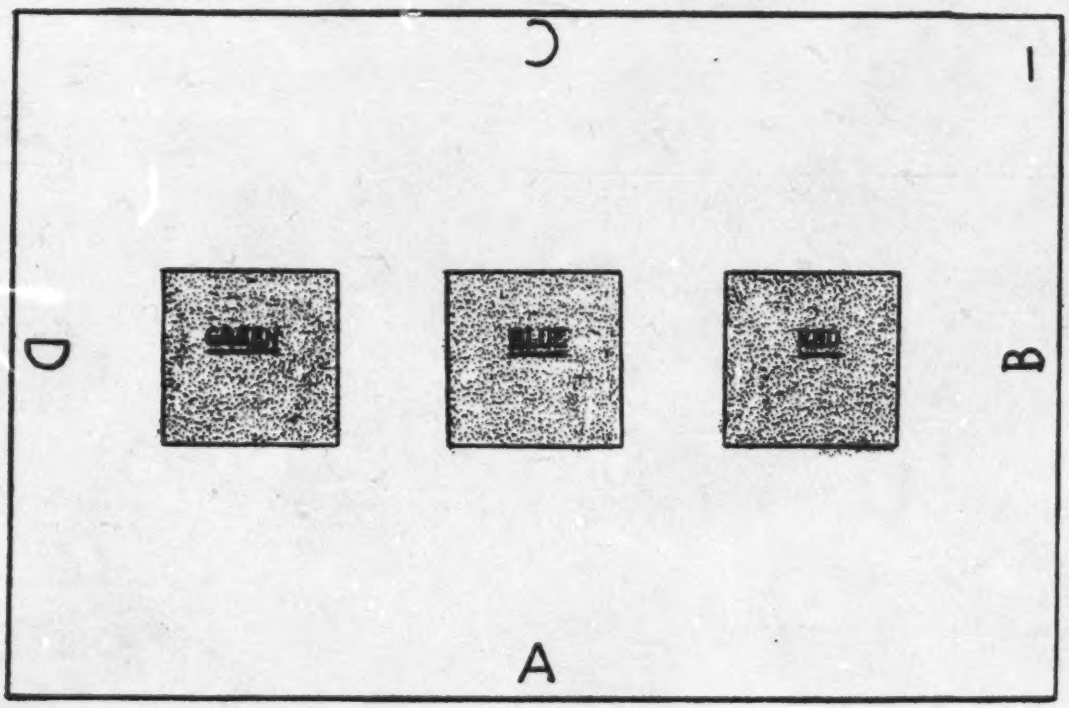
Mark the sheets 1, 2, 3, 4. Look at the pictures on the next pages to see how to do this.

Put Sheet No. 1 on your desk. Be sure the "A" faces you. The "B" is on your right. The "D" is on your left.

WORKSHEET NO. 3 (cont.)

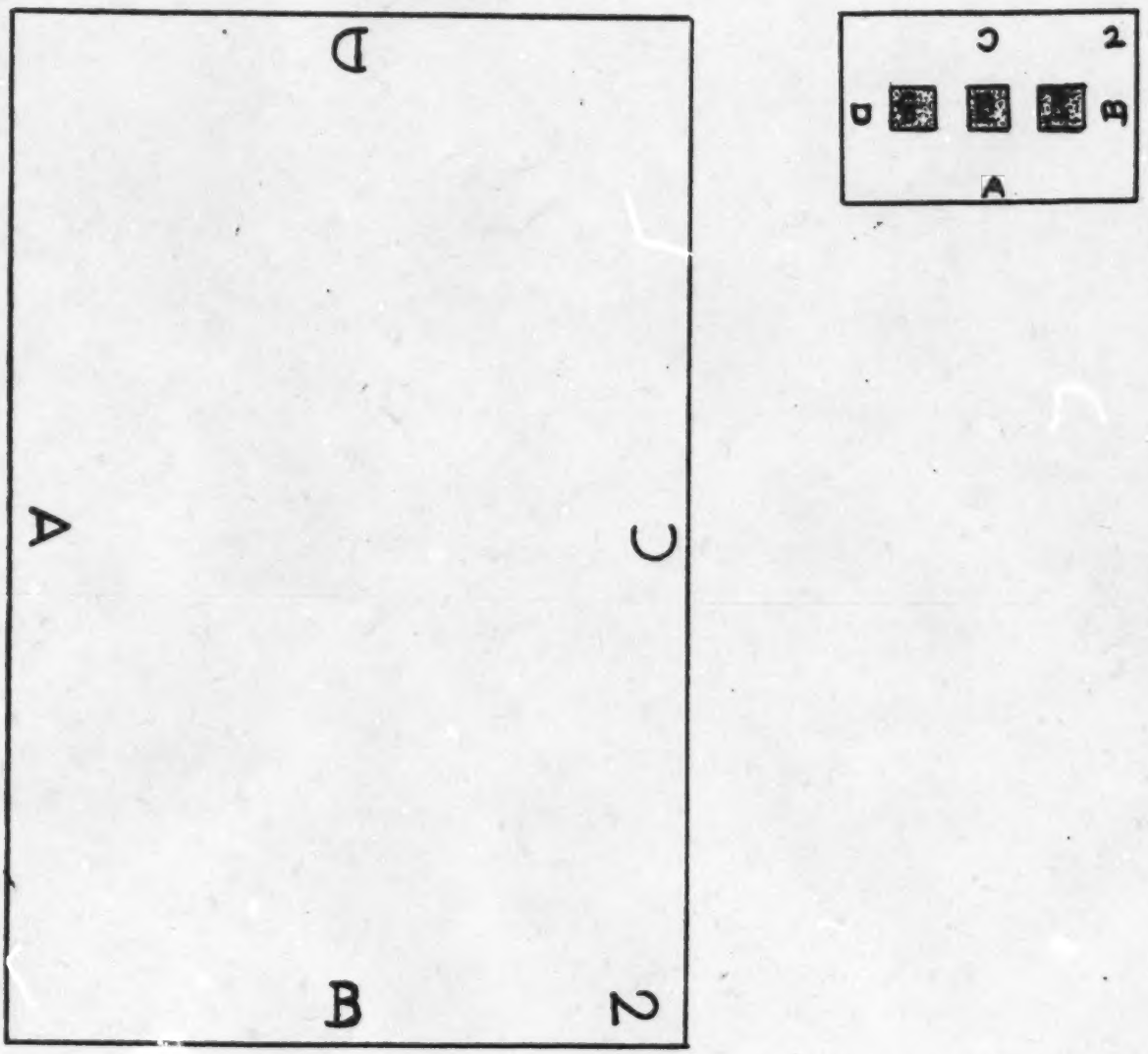
Put the shapes on Sheet No. 1 in the places as shown in the picture.

Move the blue shape toward "C". Draw a blue arrow (⟶) to show the direction the blue shape was moved.



WORKSHEET NO. 3 (Cont.)

Place the shapes on Sheet No. 2 as shown.

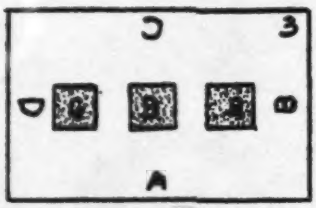


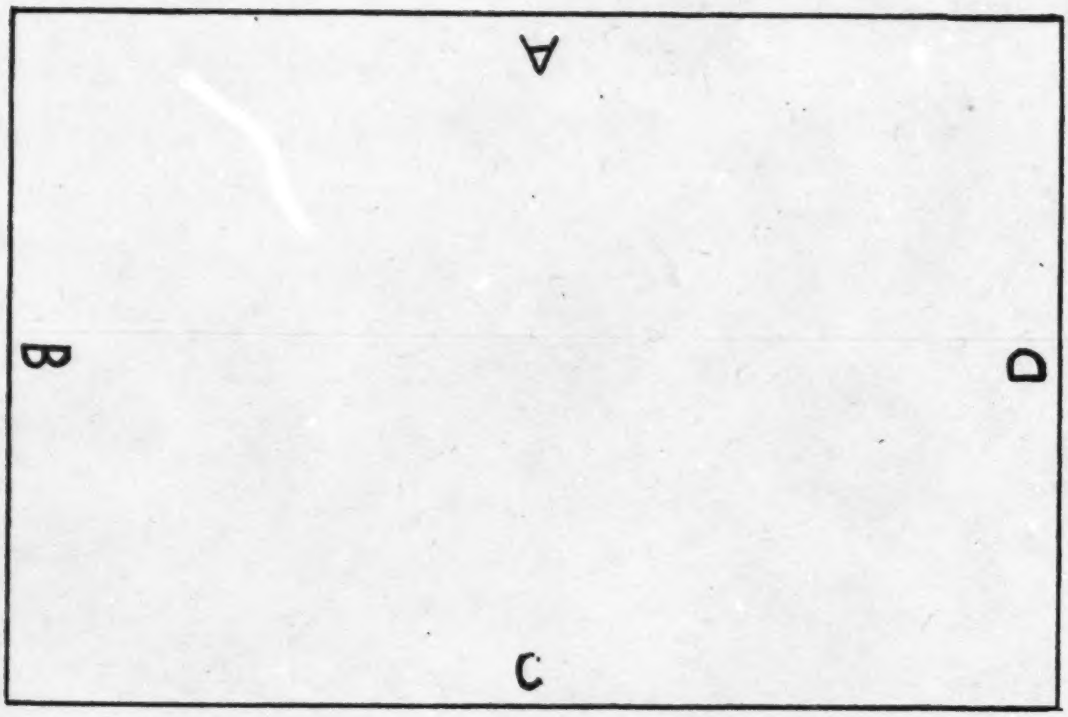
Stand at "B". Draw what you see.

Move the blue shape toward "C". Draw a blue arrow on Sheet No. 2 to show the direction the blue shape was moved.

WORKSHEET NO. 3 (Cont.)

Place the shapes on Sheet No. 3 as shown.



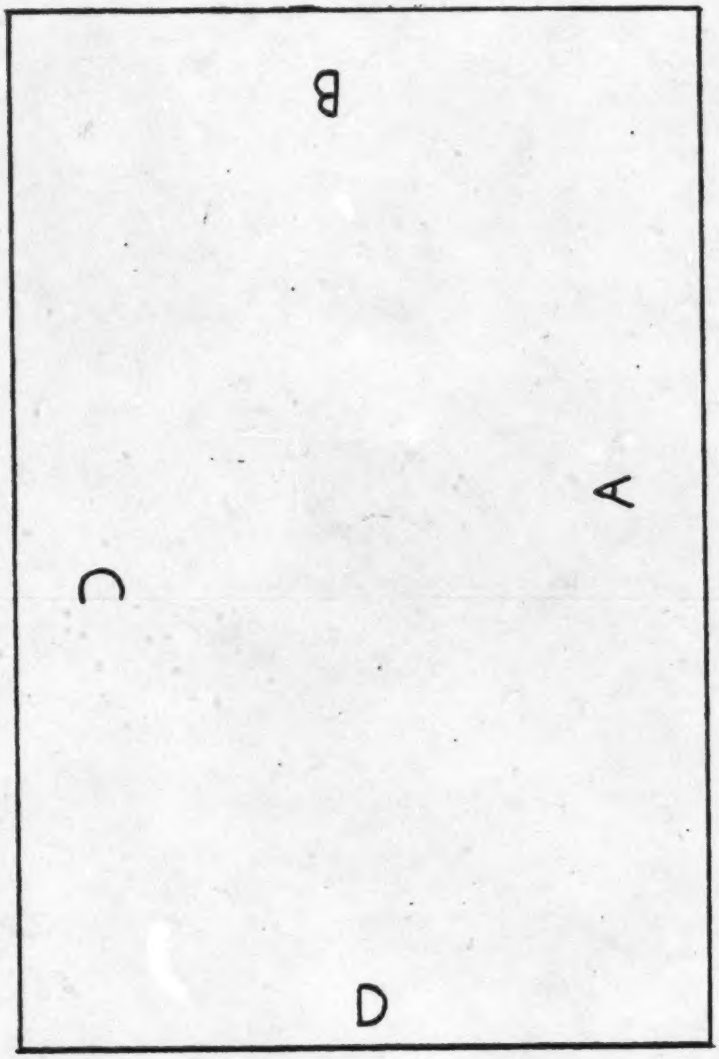


Stand at "C". Draw what you see.

Move the blue shape toward "C". Draw a blue arrow on Sheet No. 3 to show the direction the blue shape was moved.

WORKSHEET NO. 3 (Cont.)

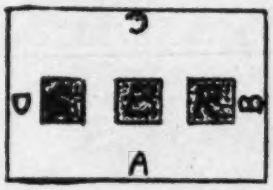
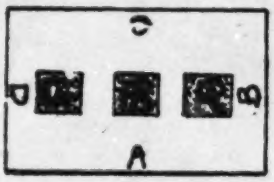
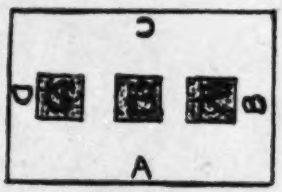
Place the shapes on Sheet No. 4 as shown.



Stand at "D". Draw what you see.
Move the blue shape toward "C". Draw a blue arrow to show the direction the blue shape was moved.

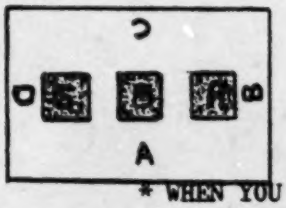
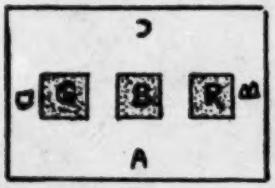
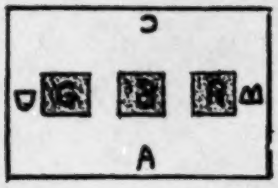
WORKSHEET NO. 3 (Cont.)

Look at the shapes on Sheet No. 1. Put them in the order shown below. Where were the green shapes each time?

	ON YOUR RIGHT	ON YOUR LEFT	IN FRONT OF YOU
* WHEN YOU STOOD HERE			
 * WHEN YOU STOOD HERE			
*WHEN YOU STOOD HERE 			
WHEN YOU * STOOD HERE 			

WORKSHEET NO. 3 (Cont.)

Where was the red shape each time?

	ON YOUR RIGHT	ON YOUR LEFT	IN FRONT OF YOU
 * WHEN YOU STOOD HERE			
 * WHEN YOU STOOD HERE			
* WHEN YOU STOOD HERE 			
WHEN YOU STOOD HERE *			

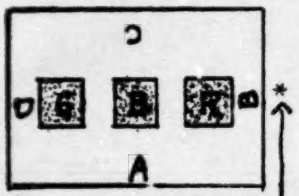
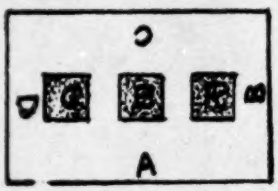
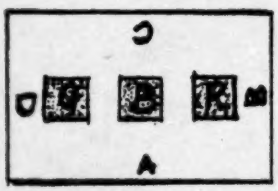
The green and red shapes were not moved.
Why did they seem to be in different places?

_____

_____

WORKSHEET NO. 3 (Cont.)

Which way was the blue shape moved?

	TO YOUR LEFT	TO YOUR RIGHT	TOWARD YOU	AWAY FROM YOU
WHEN YOU STOOD HERE				
 WHEN YOU STOOD HERE				
WHEN YOU STOOD HERE 				
WHEN YOU STOOD HERE 				

WORKSHEET NO. 3 (Cont.)

Put the 4 sheets over each other. Be sure the letters match.

Hold the sheets up together toward the light so you can see all the arrows.

Do the arrows point in the same direction?

Yes_____ No_____

Each time the blue shape was moved toward "C", why did it seem to be moved in different directions?

_____

_____

_____

_____

LESSON III-A: HOW CLOCK HANDS MOVE

Purpose: An object can move in a circular path around a fixed point.

Procedure:

1. The student worksheets should guide your students through this activity without trouble. Each worksheet is self explanatory.

2. Remember—the student's ability to tell time should not be a factor in this series of activities. What is important is his experience with rotary motion. If a child does not know where the hands will be at 6:15, tell him so he can draw them on his picture and indicate the direction of motion.

3. You may choose to do this series of activities as a group, however equipment is provided for student involvement.

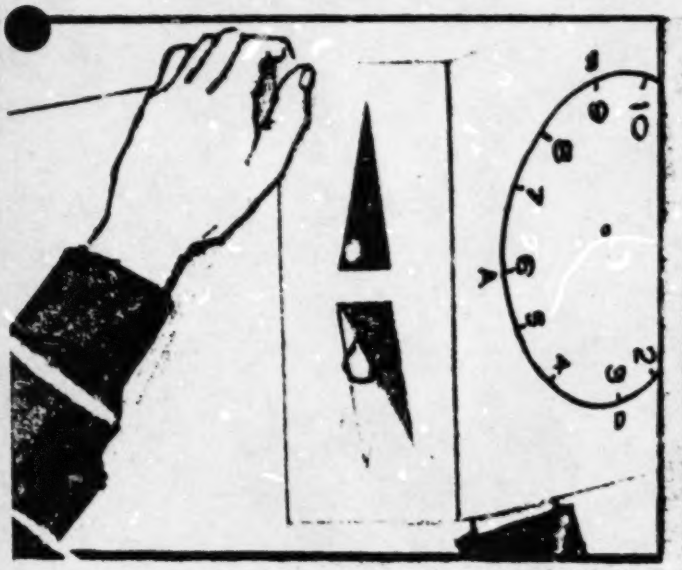
Worksheet #4

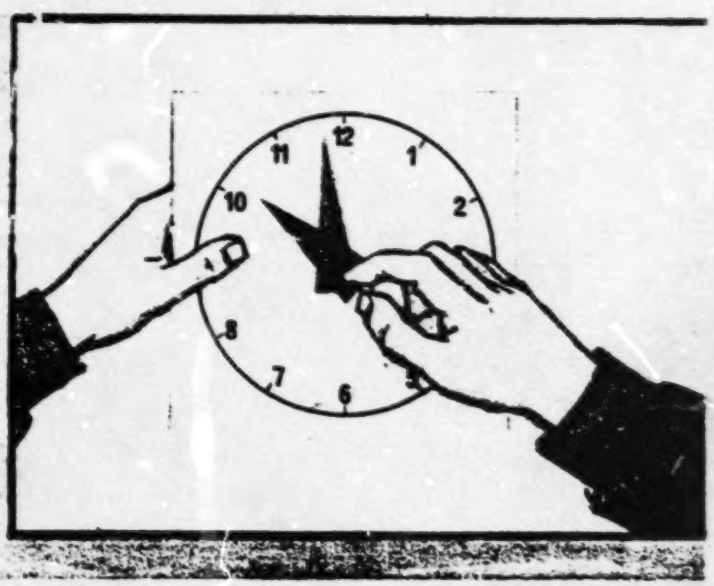
1. Each student places the model clock on his desk so that "A" faces him. He moves the big hand (minute hand) one hour. He records the new position on the first picture on page 18 using blue crayon, etc.

2. In discussing their observations, the students should conclude that by standing in front of the clock face, the hands always seemed to move in a "clockwise" direction.

Materials:	KIT	NON-KIT
	15 clock faces	Worksheets #4

How clock hands move

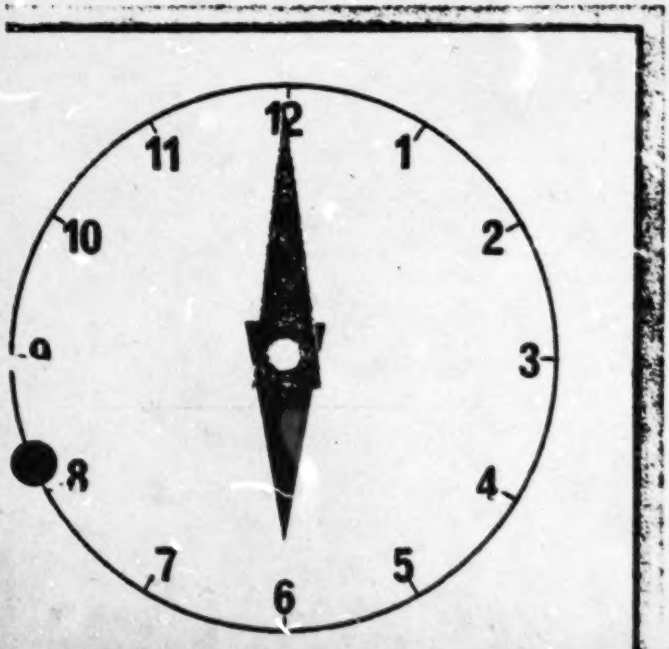




WORKSHEET #4

Put your model clock together this way.

Set the hands of the clock at six o'clock as shown in the picture below.



Where will the hands be at 6:15?

Draw the minute hand in blue. Draw the hour hand in red. Use arrows to show the direction each hand moved between 6:00 and 6:15.

WORKSHEET #4 (Cont.)

1 **Show where the minute hand will be after one hour. Draw an arrow to show the direction it moved.**

1

2 **Show where the hour hand will be after one hour. Draw an arrow to show the direction it moved.**

2

3 **Show where the hour hand will be after 12 hours. Draw an arrow to show the direction it moved.**

3

Think about clocks that are running. Think about how their hands move.

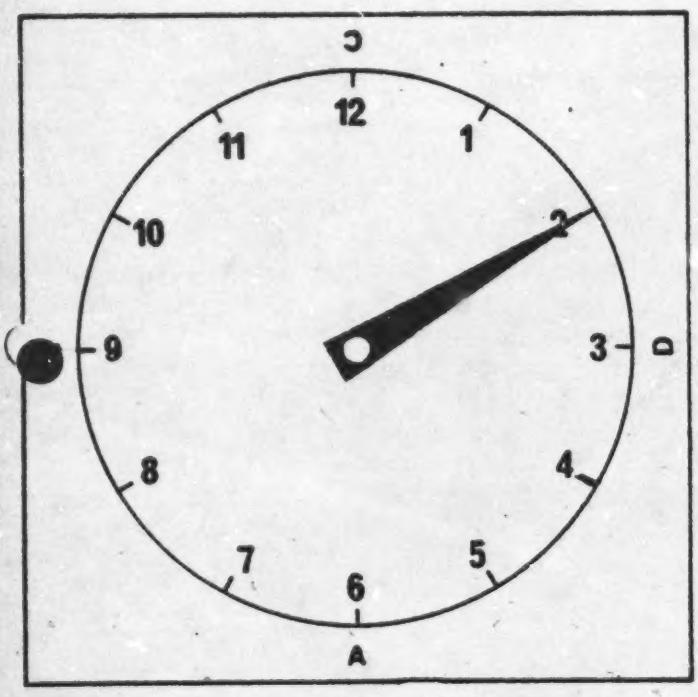
Do the hands always move in the same direction?

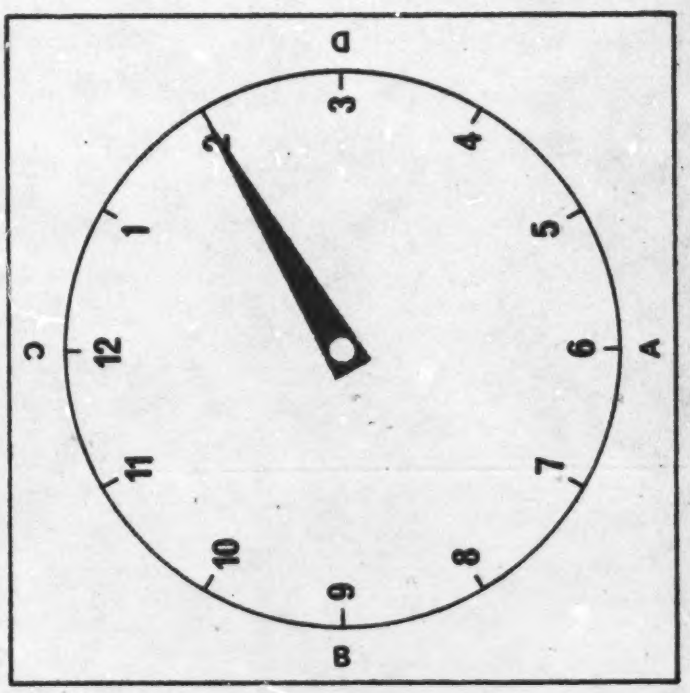
_____

WORKSHEET #4 (Cont.)

Clockwise

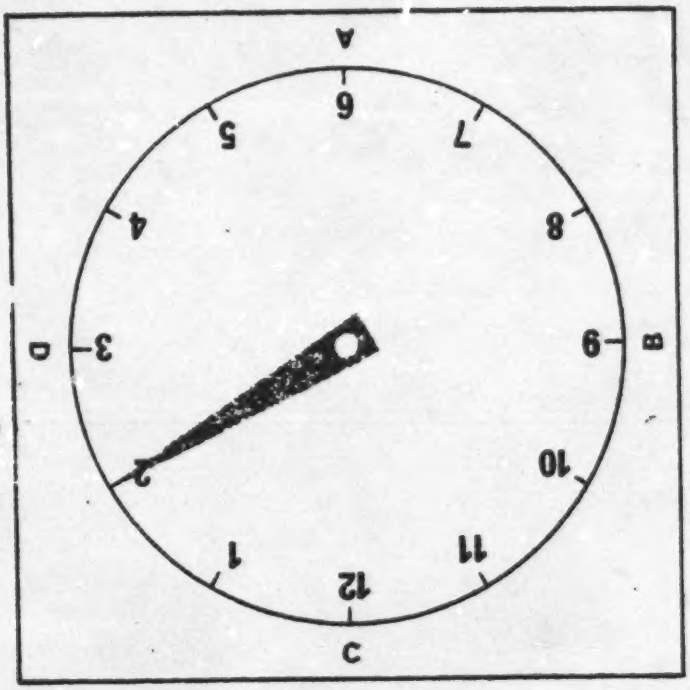
Clock hands move around in a circle. Both hands move in the same direction. We call this direction clockwise.



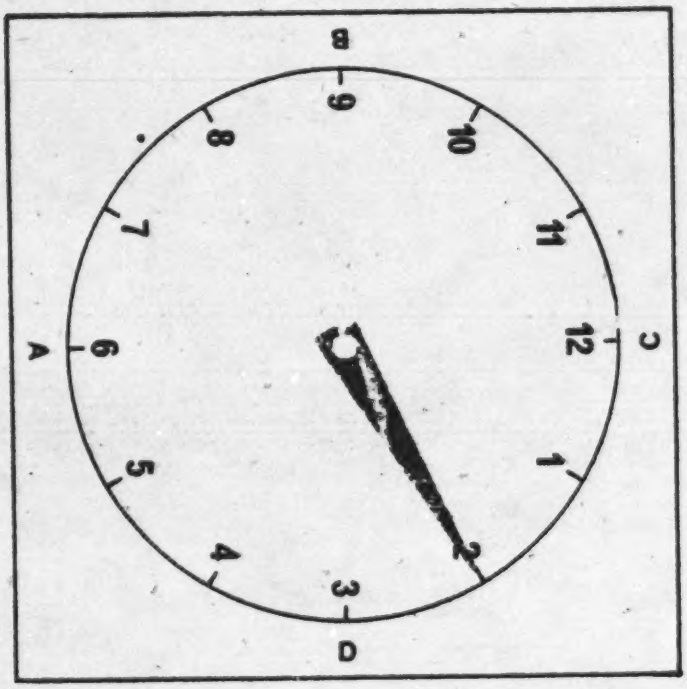


Stand at "A." Move the minute hand. Show where it will be after one hour. Use an arrow to show the direction the hand moved.

Stand at "B." Move the minute hand. Show where it will be after one hour. Use an arrow to show the direction the hand moved.



3. Do the same at "C."



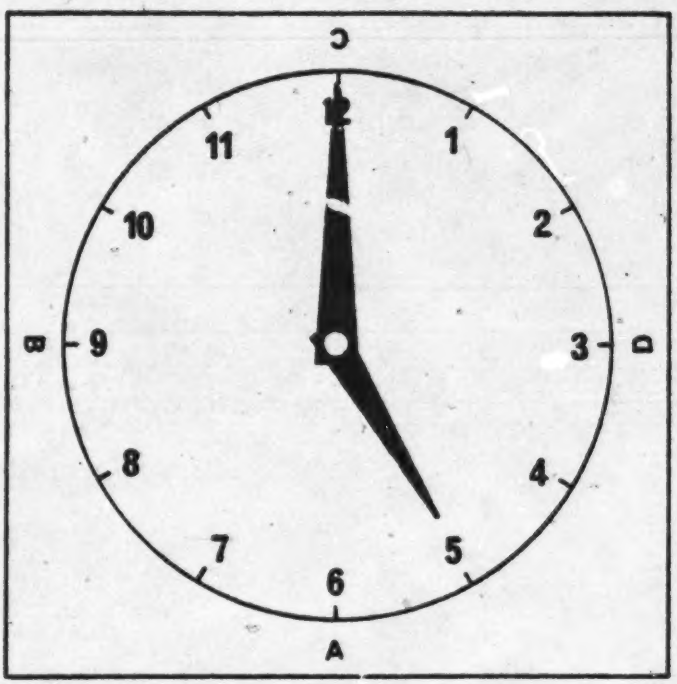
4. Do the same at "D."

Counterclockwise

WORKSHEET #4 (Cont.)

The hands on a clock move in a clockwise direction. Some things turn in the opposite direction. We say they move counterclockwise.

Set your model clock at 5:00. Pretend that it is one hour fast. Set the clock back one hour. Draw the hands in their new positions on this picture. Use arrows to show the direction the hands moved.



LESSON IV: HOW DO YOU KNOW SOMETHING IS MOVING?

Purpose: To observe that one describes motion by observing a change of position.

Procedure:

1. Choose two students to toss a large ball to each other in front of the class. The key question to ask is, "How do you know the ball moved?" Build up to this by questions such as "Did the ball move?" The answer you seek is that the ball moved relative to some fixed point such as the earth's surface, blackboard, person who threw it, etc.

2. Have the students look at the clock. Watch them closely. Can you see the hands move? They can certainly see the second hand move if you are fortunate enough to have an old-fashioned clock. Some close observation will show motion of the minute hand is noticeable; however, the hour hand cannot be observed to move. Ask the students if it does move. How can they tell? They should respond by saying that it is in a different place so it must have moved.

3. Put the toy truck on the table and pull or push it across. Ask, "Did it move?" (Answer is "yes"). Now put a block or some other item into the toy truck. Move it across the table again and ask, "Did the block move?" You should get two answers; one, "yes" with respect to the table and two, "no" with respect to the truck; there is no motion of the block.

Materials:	KIT	NON-KIT
	Toy truck	None

LESSON V: FORCE AND MOTION

Purpose: To see that force and motion are directly related to each other.

Materials: Eight marbles for each group, a pair of meter sticks for each group (meter sticks or yardsticks are preferable).

Procedure:

1. Have the groups tape down their rulers flat on their desks so that they form a groove between them just large enough for the marbles to roll along. Make sure there is no tape in the groove itself. (The rulers are only guides for the marbles and are not used for measuring, since the force the students apply may vary considerably).

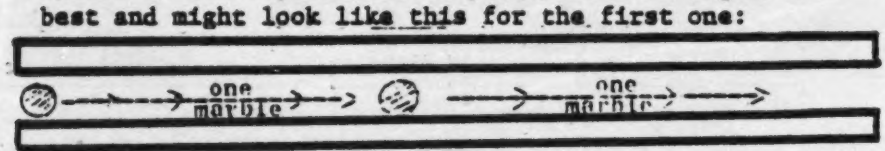
2. Have the students set one marble in the groove at about the midpoint of the rulers and then gently roll another marble down the groove from one end so that it hits the midpoint marble. Make sure that they are rolling it gently, and let them practice so that they roll it with about the same force each time. They should have noticed that the rolled marble stops, and the midpoint marble continues on. Explain that the pushing force they used to roll the marble is transferred to the midpoint marble which then moves on. They could roll the marble, without the midpoint marble being there, to see that their push would carry the marble that far. (There is some loss of energy due to friction, but it can be ignored here.) Tell them that they are now going to experiment further with this transfer of force (transfer of energy).

3. The first series of experiments will be rolling one marble toward one marble at the midpoint, then toward two marbles side by side (touching) at the midpoint, then three marbles at the midpoint, then four, and then five.

   The second series will be rolling two marbles simultaneously toward one at the midpoint, then toward two, then three, etc. The third series will be rolling three marbles simultaneously toward one at the midpoint then two, etc.

   Students should try to always use the same pushing force.

4. Careful observation is the key to this experiment, but the students will probably be so interested and involved that this will take care of itself. You may want to have your class (or your better students) try to make a written record of the experiment. A pictorial form might work best and might look like this for the first one:



and like this for a later one:

LESSON V: FORCE AND MOTION (continued)

5. Once the pictorial representation is established you then might want to record the data in a table form. Such a table migh appear as follows:

NUMBER OF MARBLES	NUMBER OF MARBLES HIT	NUMBER OF MARBLES KNOCKED OFF
1		
2		
3		
4		
5		

Many combinations of this can be worked out.

Materials: KIT

120 marbles
30 meter sticks